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Facility Effluent Monitoring Plan for K Area Fuel Storage Basins

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Prepared for the U.S. Department of Energy
Office of Environmental Restoration
and Waste Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

Approved for Public Release

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Facility Effluent Monitoring Plan for K Area Fuel Storage Basins

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Westinghouse Hanford Company

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Columbia Energy and Environmental Services

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FACILITY EFFLUENT MONITORING PLAN FOR K AREA FUEL STORAGE BASINS

ABSTRACT

A facility effluent monitoring plan is required by the U.S. Department of Energy in DOE Order 5400.1 for any operations that involve hazardous materials and radioactive substances that could impact employee or public safety or the environment. This document is prepared using the specific guidelines identified in* A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, WHC-EP-0438**. *This facility effluent monitoring plan assesses effluent monitoring systems and evaluates whether they are adequate to ensure the public health and safety as specified in applicable federal, state, and local requirements.*

This facility effluent monitoring plan is the first annual report. It shall ensure long-range integrity of the effluent monitoring systems by requiring an update whenever a new process or operation introduces new hazardous materials or significant radioactive materials. This document must be reviewed annually even if there are no operational changes, and it must be updated as a minimum every three years.

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*General Environmental Protection Program, *DOE Order 5400.1, U.S. Department of Energy, Washington, D.C., 1988.*
**A Guide for Preparing Hanford Site Facility Effluent Monitoring Plans, *WHC-EP-0438, Westinghouse Hanford Company, Richland, Washington, 1991.*

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LIST OF TERMS

ACV	administrative control values
ALARA	as low as reasonably achievable
ANSI	American National Standard Institute
APCA	Air Pollution Control Authority
ASME	American Society of Mechanical Engineers
BACT	best available control technology
CAA	*Clean Air Act of 1977*
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	Code of Federal Regulations
CEMS	continuous emission monitoring systems
CWA	*Clean Water Act of 1977*
D&D	decontamination and decommissioning
DCG	derived concentration guides
DOE	U.S. Department of Energy
DOT	Department of Transportation
DSHS	Department of Social and Health Services
DW	dangerous waste
ECL	environmental control limits
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
EG&G	EG&G Idaho, Inc.
EHW	extremely hazardous waste
EMP	Effluent Monitoring Plan
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
ES&H	Environmental Safety and Health
FEMP	Facility Effluent Monitoring Plan
FWPCA	*Federal Water Pollution Control Act*
HEIS	Hanford Environmental Information System
HEPA	High Efficiency Particulate Air (Filter)
hp	horsepower
HW	hazardous waste
KE	K East Area
KW	K West Area
MDC	minimum detectable concentration
MK	Mark
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIST	National Institute of Standards and Technology
NPDES	National Pollution Discharge Elimination System
OCN	Occurrence Notification System
OSM	Office of Sample Management
ORS	Office of Regulatory Support
OSR	Operations Safety Requirements
OSS	Office of Support Services
OSTI	Office of Scientific and Technical Information
PNL	Pacific Northwest Laboratories
PSD	prevention of significant deterioration
PUREX	Plutonium Uranium Extraction

LIST OF TERMS (continued)

QA	Quality Assurance
QAPP	Quality Assurance Program Plan
QC	Quality Control
QI	Quality Instructions
QR	Quality Regulations
RACT	reasonable available control technology
RCRA	*Resource conservation and Recovery Act of 1976*
RCW	Revised Code of Washington
RL	U.S. Department of Energy, Field Office, Richland
SARA	*Superfund Amendments and Reauthorization Act of 1986*
TLD	thermoluminescent dosimeter
TRS	total reduced sulfur compounds
WAC	Washington Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company

METRIC CONVERSION CHART

INTO METRIC		
If you know	Multiply by	To get
Length		
inches	2.54	centimeters
feet	30.48	centimeters
feet	0.3048	meters
Volume		
gallons	3.786	liters
cubic feet	0.02832	cubic meters
Weight		
pounds	0.45359	kilograms
Temperature		
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius
Pressure		
inches water	1.87	mm Hg
inches water	249	Paschal (Pa)
OUT OF METRIC		
Length		
centimeters	0.3937	inches
meters	3.28	feet
Volume		
milliliters	1.247×10^{-3}	cubic feet
liters	0.264	gallons
cubic meters	35.31	cubic feet
Weight		
kilograms	2.2046	pounds
Temperature		
Celsius	Multiply by 9/5ths, then add 32	Fahrenheit
Pressure		
mm Hg	0.5353	inches water
Paschal (Pa)	4.02×10^{-3}	inches water

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FACILITY EFFLUENT MONITORING PLAN FOR K BASINS

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) issued DOE 5400.1 (DOE 1988b) which requires each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials to have an environmental monitoring plan. This plan consists of a Facility Effluent Monitoring Plan (FEMP) and an environmental surveillance plan. The facilities in the 100-K Area release radionuclides to the environment and require a FEMP. This FEMP for the 100-K Area, which includes the K East Area (KE) and K West Area (KW) Fuel Storage Basins and the Engineering Laboratory, has been prepared to ensure that releases are monitored, the quantities measured, and the impacts to the public are evaluated.

This plan was developed as a result of the operational FEMP determination for 100-K Area Storage Basins and Engineering Laboratory (WHC 1991b) that was completed in March 1991. The K Area FEMP determination evaluated the gaseous emissions and liquid effluent of 105-KE and 105-KW Fuel Storage Basins, 1706-KE Environmental and Engineering Demonstration Laboratory (1706-KEL), and the 1706-KE Water Studies Recirculation Building (1706-KER) and determined the potential annual radiation exposure to the maximally exposed individual offsite. This evaluation determined the degree to which Westinghouse Hanford Company (Westinghouse Hanford) must monitor the 100-K Area airborne emissions and liquid effluents. The 105-KE and 105-KW Fuel Storage Basins' airborne emissions and liquid effluents must be periodically monitored as long as fuel is present. This FEMP is developed for the normal operating conditions of the basins and the engineering laboratory as required by the DOE, U.S. Environmental Protection Agency (EPA) and the state of Washington.

The 100-KE/KW operating facilities are also subject to the DOE 5400 series, due to their release of radioactivity to both air and water. These orders require that radioactive effluents to the environment be as low as reasonably achievable (ALARA) and use the best available control technology (BACT) to control effluents. The effluents must be monitored to ensure that regulatory requirements are met, and a monitoring plan and procedures must be in place to ensure they are implemented.

1.1 POLICY

DOE 5400.1 requires a FEMP for each facility that contains hazardous materials that could impact public and employee safety and the environment. A FEMP is required to measure and monitor the effluents from the facilities and to calculate, from the effluent data, the effects of those operations on the environment and the public health and to demonstrate the existence of high standards of quality and credibility.

The objective of the 100-K Area Fuel Storage Basins and Engineering Laboratory FEMP is to demonstrate compliance with federal, state and local regulatory requirements, confirm that the facilities adhere to DOE environmental protection policies, and support the DOE/Westinghouse Hanford environmental management decisions.

DOE 5400.1 Chapter IV requires that the environmental monitoring meet the requirements in the order and be implemented at 100-K Area no later than 36 mo after the effective date, which is November 9, 1991.

1.2 PURPOSE

The primary purpose of the 100-K Area Fuel Storage Basins and Engineering Laboratory FEMP is to ensure that the radioactive effluents emanating from the facilities during operations are properly monitored and evaluated for compliance with DOE orders and agencies regulatory requirements at the federal, state and local level.

The effluent monitoring plan provides a monitoring program that collects representative samples in accordance with industry standards, performs analysis within stringent quality control (QC) requirements, and evaluates the data calibrated models. The data ensures that the intent of DOE Order 5400.1 is met and maintained.

1.3 SCOPE

The scope of the FEMP includes plans for collecting representative samples, obtaining valid analytical results, and maintaining proper documentation of the radioactive and nonradioactive effluents from the 100-K Area Fuel Storage Basins and Engineering Laboratory facilities for both the air and water pathways to the environment. The plan provides for monitoring radioactive materials and chemicals that may be discharged during routine and/or upset conditions and documenting the monitoring systems.

1.4 DISCUSSION

The KE/KW Reactors were built in the 1950's and were shut down by 1971. Effluents from the KE/KW Reactors ended in the early 1970's. In 1975 the KE/KW basins were modified to provide temporary storage for irradiated fuel from N Reactor until it could be processed at the Plutonium Uranium Extraction (PUREX) plant. Since the 1970's the air emissions and liquid effluents emitted from KE/KW originate only from the Fuel Storage Basins and the Engineering Laboratory. Therefore, this FEMP is limited to the effluents from the Fuel Storage Basins at 105-KE and 105-KW and the Engineering Laboratory at 1706-KE and associated plant backwash discharge.

1.4.1 Radionuclide Effluent Releases

Radionuclides are emitted from KE/KW at four locations for air emissions and one liquid effluent discharge. Radionuclides are discharged to the air from the 105-KE Fuel Storage Basin, the 105-KW Fuel Storage Basin, the 1706-KE Environmental and Engineering Demonstration Laboratory (1706-KEL) and the 1706-KE Water Studies Recirculation Building (1706-KER). Radionuclides are discharged to the Columbia River from one discharge point located at the 1908-KE Outfall, also known as National Pollution Discharge Elimination System (NPDES) Outfall 004 (EPA 1981). The radionuclides emitted from the effluent release points via the air pathway and via the liquid effluent pathway are: ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, and ^{240}Pu.

Due to the release of these radioisotopes to the air environment, effluents from the 105-KE/KW Fuel Storage Basins, 1706-KEL, and 1706-KER are subject to the "National Emission Standard for Emissions of Radionuclides other than Radon from Department of Energy Facilities" as specified in EPA Title 40 Code of Federal Regulations (CFR), Part 61, Subpart H (EPA 1989c).

1.4.2 Nonradioactive Chemical Effluent Releases

The potential nonradioactive hazardous air pollutants considered in the 100-K Area FEMP determination, are those listed in EPA 40 CFR Part 61.01(a) and 40 CFR Part 61.01(b). It was determined that none of the chemicals listed, with the exception of radionuclides, are present in the airborne releases from the 100-K Area. Therefore, radionuclides are the only hazardous air pollutants considered in this FEMP.

The single liquid release point to the Columbia River for the KE and KW operating facilities was reviewed in the 100-K Area Determination to determine the potential to release hazardous waste. The 1908-KE Outfall is a permitted NPDES Outfall and the extensive analysis performed as part of the permit application in 1986 on this outfall does not indicate any potential for release of nonradioactive hazardous material.

1.5 K FACILITY EFFLUENT MONITORING PLAN RESPONSIBILITIES

In order to effectively implement the FEMP, the organization and responsibilities of Westinghouse Hanford management are identified in Section 12.0, Quality Assurance (QA). The FEMP identifies the N Reactor Operations manager as having overall responsibility for direction of sampling and test activities. The specific responsibilities of the Fuels K/D Operations manager, the K Basin Operations manager, Hazardous and Radiological Waste Control, and the Reactor Engineering groups are defined in the QA program.

The organization and responsibilities of the supporting organizations in implementing the FEMP are identified in Sections 12.2.1 and 12.2.2. These organizations are the Office of Sample Management (OSM), 100 Area Environmental Protection, 100 Area Facilities Health and Safety, N Reactor QA, and N Reactor Maintenance.

Samples taken for the FEMP will be shipped to approved Westinghouse Hanford laboratories an approved laboratory contractor as shown in Section 12.2.3, Analytical Laboratories.

1.6 DEFINITIONS

Accuracy. The degree of agreement of measurement with an accepted reference or true value.

Adequate. Able to monitor the facility effluents with a reasonable degree of error.

Administrative Control Values (ACV). Contractor-imposed radionuclide and hazardous material release limits usually based upon ALARA goals for protection of the public.

Anisokinetic Sampling. A condition that exists when the velocity of air entering a sampling probe held in an airstream is different from the airstream being sampled at that point.

Authorities. Any government agencies or recognized scientific bodies which by their charter define regulations or standards dealing with radiation protection and hazardous material.

Bias. A consistent under or over estimation of a true value.

Calibrate. Adjustment of the system and the determination of system accuracy using one or more sources traceable to the National Institute of Standards and Technology (NIST).

Check Source. The use of a source to determine if the detector and all electronic components of the system are operating correctly.

Composite Sampling. This includes both uninterrupted sampling and repetitive sequential collection of small samples obtained automatically at intervals short enough to yield a representative sample for the entire sampling period.

Continuous Monitoring. The real time measurement of liquid, gaseous, and/or airborne effluents and contaminants using an in situ measurement system.

Continuous Sampling. Includes both non-interrupted sampling and repetitive sequential sampling to obtain a representative sample.

Contractor. A company or entity that has entered into a prime contract to operate a Hanford facility or perform a function for U.S. Department of Energy, Field Office, Richland (RL).

Dangerous Waste. State of Washington designation for solid wastes specified in WAC 173-303-070 through 173-303-103 (WAC 1989) as dangerous waste (DW) or extremely hazardous waste (EHW).

Derived Concentration Guide (DCG). The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode, would result in an effective dose equivalent (EDE) of

100 mrem. The DCGs do not consider decay products when the parent radionuclide is the cause of the exposure. The DCGs are listed in DOE Order 5400.5 Chapter III (DOE 1990b) and in individual contractor safety manuals.

Detector. Any device for converting radiation flux to a signal suitable for observation and measurement.

Discharge Point or Effluent Discharge Point. The point at which an effluent or discharge enters the environment from the facility in which it was generated.

Effective Dose Equivalent. The EDE is the summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The EDE includes the committed EDE from internal deposition of radionuclides and the EDE due to penetrating radiation from sources external to the body; it is expressed in units of rem (or sievert).

Effluent. Any treated or untreated air emission or liquid discharge at a DOE site or from a DOE facility.

Effluent Monitoring. Measurement of liquid and gaseous effluents for the purpose of characterizing and quantifying contaminants, assessing radiation exposures to members of the public, providing a means to monitor and/or control effluents at or near the point of discharge, and demonstrating compliance with applicable standards and permit requirements.

Effluent Sampling. The continuous or intermittent collection and analysis of effluent samples for the purpose of characterizing and quantifying contaminants, assessing radiation exposures to members of the public, providing a means to control effluents at or near the point of discharge, and demonstrating compliance with applicable standards and permit requirements.

Environmental Control Limits (ECL). Contractor limits based upon permit limits and contractor policies as derived from DOE requirements.

Environmental Occurrence. Any sudden or sustained deviation (categorized as emergencies, unusual occurrences, or off-normal occurrences) from a regulated or planned performance at a DOE operation that has environmental protection and compliance significance. Typical occurrences of interest to this document include failure of primary or secondary facility effluent monitoring equipment or a monitored/unmonitored release of regulated materials exceeding ACVs.

Environmental Surveillance. The collection and analysis of samples, or direct measurements, of air, water, soil, foodstuffs, biota, and other media and their environs to determine compliance with applicable standards and permit requirements, assess radiation exposures to members of the public, and assess the effects, if any, on the local environment.

Extremely Hazardous Waste. State of Washington designation for waste, specified in WAC 173-303-070 through 173-303-103 (WAC 1989).

Hazardous Materials. DOE term for nonradioactive hazardous substances as specified by EPA 40 CFR Part 302 (EPA 1989a).

Hazardous Waste. Solid wastes designated by EPA 40 CFR Part 261, and regulated as hazardous wastes by the EPA or the state of Washington (WAC 1989). This term includes DW, EHW, and toxic dangerous waste.

In Line. A system where the detector assembly is adjacent to or immersed in the total effluent stream.

In-Line Monitor. A system in which a detector or other measuring device is placed in the effluent stream for the purpose of performing measurements on the effluent stream.

Inventory at Risk. The quantity of radioactive and/or nonradioactive hazardous material present in a facility with the potential to enter a gaseous or liquid effluent stream.

Isokinetic. A condition that exists when the velocity of air entering a sampling probe held in an airstream is identical to the velocity of the airstream being sampled at that point.

Mixed Waste. Waste containing both radioactive and hazardous components regulated by the *Atomic Energy Act of 1954* and the *Resource Conservation and Recovery Act of 1976* (RCRA), respectively.

Monitoring. The use of instruments, systems, or special techniques to measure liquids, gaseous, and/or airborne effluents or contaminants.

Normal Operations. A plant operating condition where all processes and safety control devices are operating as designed.

Occurrence Notification Center (ONC). The single point of contact for reporting occurrences (emergencies, unusual occurrences, and off-normal occurrences) that affect DOE facilities on the Hanford Site.

Off-Line Monitoring. Methods where an aliquot is withdrawn from the effluent stream for collection or conveyance to a detector or instrument.

On Site. Location within a facility that is controlled with respect to access by the general public.

Out-of-Specification Condition. A condition that is outside the operating parameter(s) established for airborne emissions and liquid discharges.

Plate Out. A thermal, electrical, chemical, or mechanical action that results in a loss of material by deposition on surfaces between sampling point and detector.

Precision. The dispersion around a central point, usually represented as a variance, or standard deviation.

Primary Calibration. The determination of the electronic system accuracy when the detector is exposed in a known geometry to radiation from sources of known energies and activity levels traceable to the NIST.

Quality Assurance. All those planned and systematic actions necessary to provide adequate confidence that a system or component will perform satisfactorily in service.

Radioactive Component - Refers only to the actual radionuclides dispersed or suspended in the waste substance.

Reportable Quantities. That quantity of hazardous substances as listed in 40 CFR 302.4 which, if released, requires notification according to 40 CFR 302 (EPA 1989a). These quantities also provide the criteria for requiring FEMPs with respect to nonradioactive hazardous substances.

Representative Sample. A sample taken to depict the characteristics of a lot or population as accurately as possible.

Response Time. The time interval from a step change in the input concentration at the instrument inlet to a reading of 90% (nominally equivalent to 2.2 time constants) of the ultimate recorded output.

Secondary Calibration. The determination of the response of a system with an applicable source whose effect on the system was established at the time of a primary calibration.

Sensitivity. The minimum amount of contaminant that can repeatedly be detected by an instrument.

System. The entire assembled equipment excluding only the sample collecting pipe.

Significant. The concentration of radioisotope which is equivalent or greater than 1 mrem of exposure offsite per year.

Shutdown. The condition in which a reactor facility has ceased operation and DOE has declared officially that it does not intend to operate the facility (DOE 1986b).

Shutdown Condition. A plant condition where all processes involving radioactive and/or hazardous materials are inactive and otherwise stable.

Standby. That condition in which a reactor facility is neither operable nor declared excess, and the documentation authorization exists to maintain the reactor for possible future operation (DOE 1986b).

Source Term. The amount, activity, or concentration of a hazardous or radioactive material in a facility effluent stream at the point of discharge that is available to exposure personnel either within the facility or beyond the site boundary.

Toxic Dangerous Wastes. State of Washington designation for wastes which meet the criteria specified in WAC 173-303-101 (WAC 1989).

Upset Condition. Any one condition that is outside the normal process operating parameters or an unusual plant operating condition where one material confinement/containment barrier or an engineered control has failed.

2.0 FACILITY DESCRIPTION

The 100-K Area is located on the Hanford Site approximately 25 miles northwest of Richland, Washington, as shown in Figure 2-1. The 100-K Area itself is shown in Figure 2-2. There are two identical reactors located in this area, the easternmost of the reactors is designated 105-KE and the westernmost, 105-KW.

The KE and KW reactors are two of the nine water-cooled, graphite-moderated plutonium production reactors built along the Columbia River between 1943 and 1963. All of these reactors have been retired.

The KE and KW reactors were identical reactors built approximately one-fourth of a mile apart. They both used once-through cooling. Each system included a pump house, filtration plant, clear well, combined outfall, and large basin for storage of irradiated fuel. The reactors and their support facilities were constructed between 1952 and 1954. The reactors began service in 1955, with KW ceasing operation in February, 1970, and KE in February, 1971. The reactors share a few ancillary structures; however, major support facilities were exactly duplicated.

The KE and KW reactor systems under went decontamination and decommissioning (D&D) after shut down. Most of the stored fuel was shipped to the 200 East Area for processing. When the initial D&D was complete, approximately one year was spent cleaning and modifying the fuel storage basins located within the 105-KE and 105-KW buildings to store N Reactor irradiated fuel. Additional modifications and repairs of the fuel storage basin system included modification of the basin cooling systems to a closed system and repair of a leak in the 105-KE basin. Actual storage of N Reactor irradiated fuel began in 1975 in 105-KE and in 1981 in 105-KW and continues at present. Shipments of fuel to the basins for storage ceased in 1989.

Current operations at the 100-K Area include N Reactor irradiated fuel storage in the 105-KE and 105-KW fuel storage basins and environmental laboratory work being performed in the 1706-KE facility. Work is currently being planned for reencapsulating the fuel in the 105-KE basin.

2.1 FACILITY PHYSICAL DESCRIPTION

The 100-K Area consists of 49 buildings. This FEMP covers the K Area Fuel Storage Basins (105-KE and 105-KW), the Engineering Laboratory (1706-KEL and 1706-KER), the 1908-KE Outfall (NPDES Outfall 004) and the 181-KE Filter Screen Backwash discharge (NPDES Outfall 003).

2.1.1 Fuel Storage Basins Physical Description

The 105-KE and 105-KW fuel storage basins were constructed identically. Since then, minor modifications have resulted in slight differences. The basins are both constructed out of reinforced concrete. They are rectangular, 125 ft long by 67 ft wide by 21 ft deep. The pools are divided into three

Figure 2-1. Hanford Site.

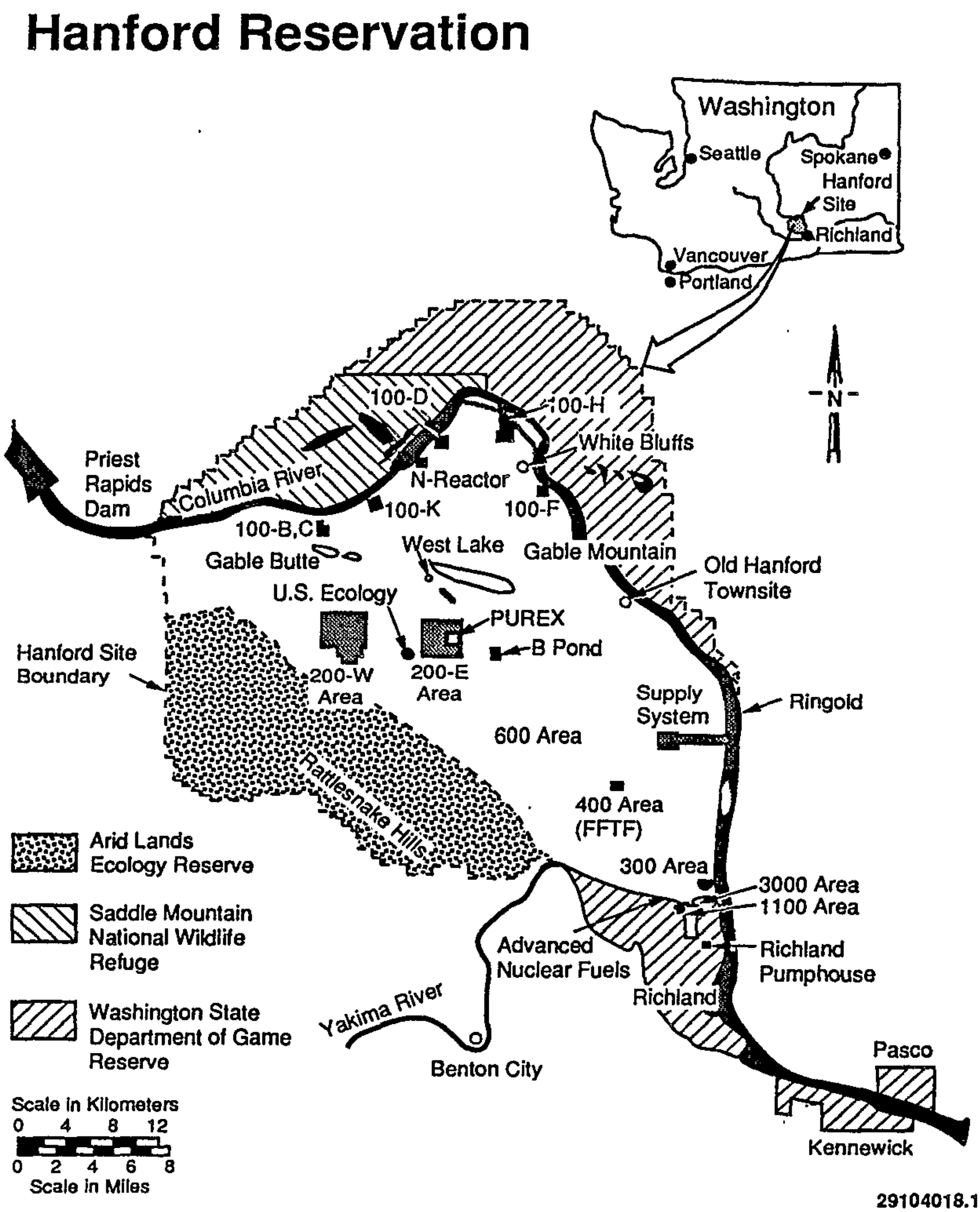
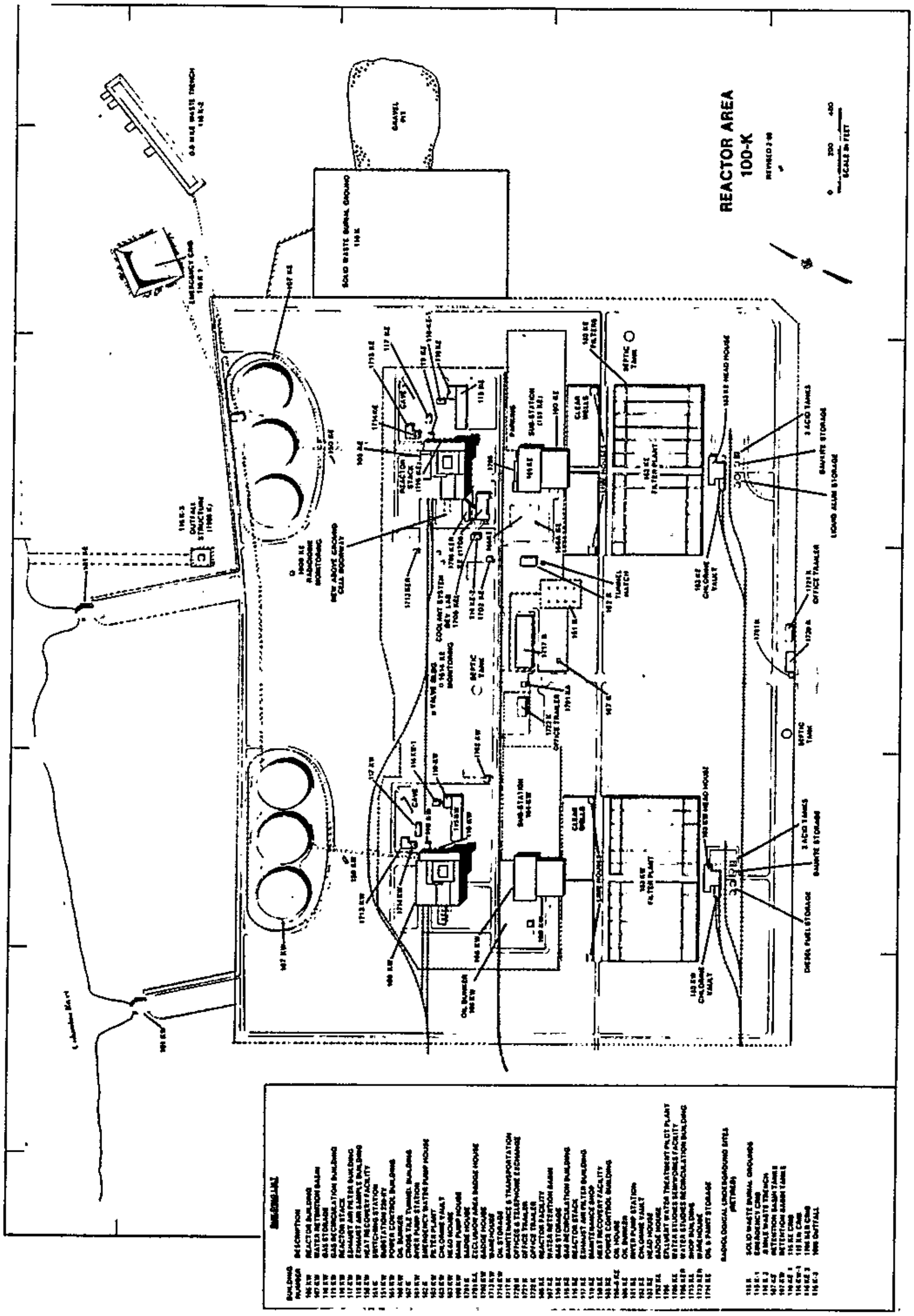


Figure 2-2. 100-K Area.



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sections by concrete walls which are open at each end, as shown in Figure 2-3. Water is maintained in each basin to a depth ranging from 15 ft 4 in. to 16 ft 8 in. The bottoms of the pools are approximately 20 ft below grade. Modifications were performed on both basins to allow storage of spent N Reactor fuels. Each basin was modified to include a recirculation system for the basin water including in-line filters, an ion exchange system, a sand filter system, heat exchanger, and instrumentation to monitor radiation levels, heat generation rate, and basin water level. This includes a remote alarm system. Both basins have racks installed on their floors for storing the N Reactor fuel canisters.

Minor differences in the two basins were the result of later modifications. All the fuel stored in the KE basin is in open containers. Presently, there is only fuel segregation equipment in the KE basin, thus, fuel segregation activities can only be performed in the KE basin.

In an effort to increase fuel storage capacity, both basins were modified to provide the capability to hang fuel canisters over those canisters stored on the floor of the basin, as shown in Figure 2-4. This increased the fuel storage capacity of each basin by a potential 375 t. Additionally, water chillers were installed in both basins to increase the heat exchange capacity. This was done to lower the basin water temperature and reduce the dose to the personnel in the basin areas. In order to remove and replace the caps on Mark (MK) I and MK II canisters, decapping equipment was installed in both basins. In the KE basin, the decapping equipment is for MK I canisters and is located adjacent to the segregation equipment. In the KW basin, the decapping equipment is for MK II canisters and is located in the transfer canal between the load out pit and the basin western bay.

Radioactively contaminated or potentially radioactively contaminated building service drains within the facilities have been intercepted and routed to a liquid effluent sump. Unused drains have been plugged and sealed with concrete. The 105-KW basin floor and walls were coated with a pliable epoxy sealant and only encapsulated fuel canisters are stored in the basin. An underbasin leakage collection system, composed of an asphalt membrane and a pipeline that formerly went to a dispersion tile field, now routes the contaminated effluents to a sump and pumps it back to the facility or to a radioactive waste holding tank.

2.1.2 Engineering Laboratory Physical Description

The Chemical and Waste Treatment Engineering Laboratory is located in the 1706-KE Building at the 100-K area. The Engineering and Environmental Demonstration Laboratory was designed as a testing complex for single pass and recirculating in-reactor test loops and prototype out-of-reactor test loops. The loops were used for studying the effects of water quality and decontamination solvents on the corrosion characteristics of reactor hardware and fuel element material.

9 2 1 2 1 9 9 7

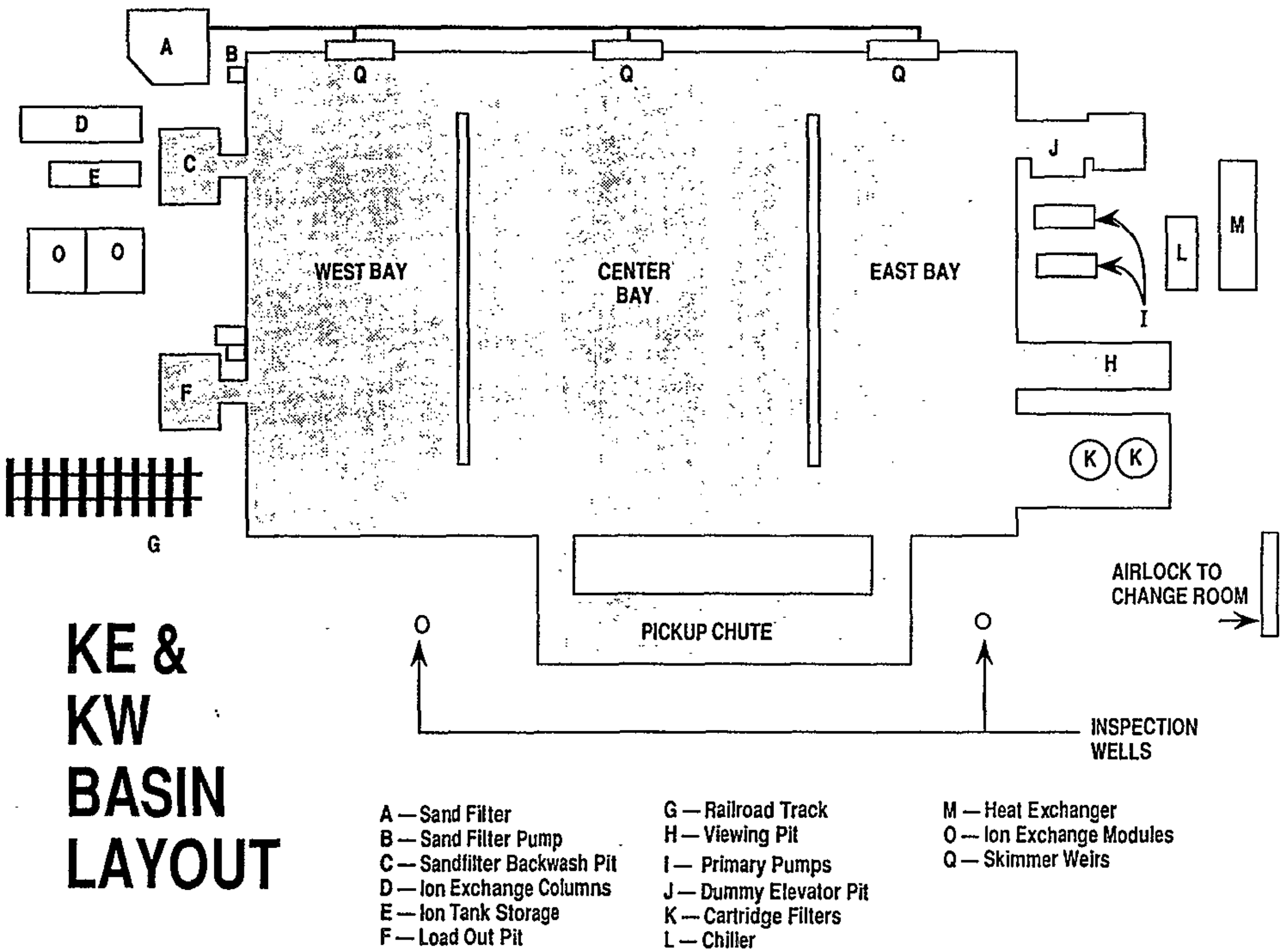
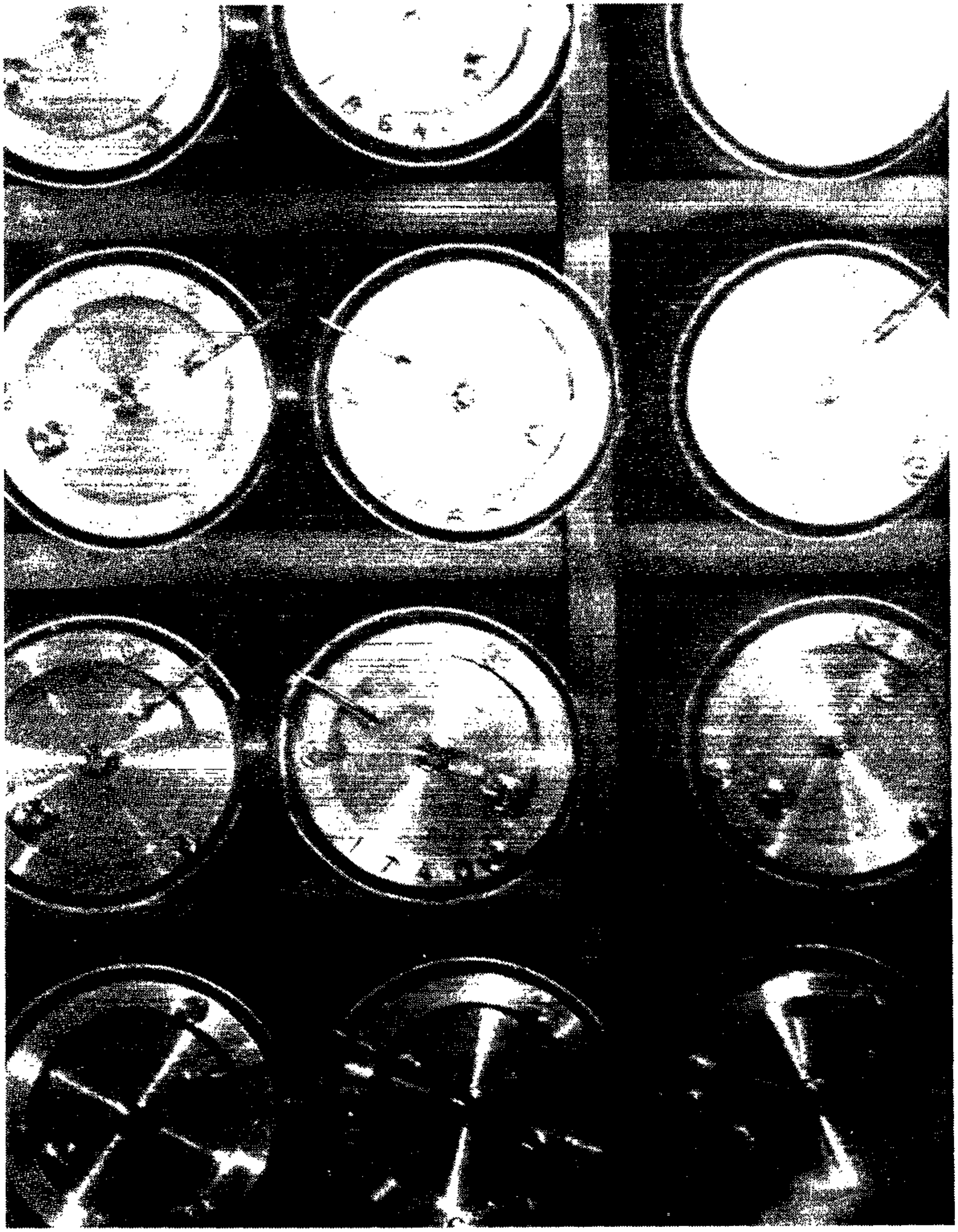


Figure 2-3. KE and KW Basin Layout.

Figure 2-4. Fuel Storage Arrangement.



The facility has been used to perform testing for operational support for N Reactor startup in 1963 and KE reactor shutdown in 1971. Among the testing programs performed were water QC, corrosion, decontamination, procedure development, waste treatment systems development, ion exchange evaluations and materials testing.

Some testing was performed at 1706-KE in support of N Reactor during stand-by. The ion exchanger in this building supplies the demineralized water to the KE/KW fuel storage basins. This facility has also performed some testing in support of D&D activities. There is currently development work involving hazardous treatment systems being conducted in 1706-KEL or 1706-KER.

The 1706-KE Engineering and Environmental Demonstration Laboratory is a complex of various building heights and additions. This facility consists of four levels:

1. Main or 9-ft level (1706-KE 0-ft level; 6,220 ft^2), Figure 2-5
2. Intermediate or 13-ft level (1706-KE 13-ft level; 3,100 ft^2), Figure 2-6
3. Lower or 21-ft level (1706-KER 21-ft level; 4,820 ft^2), Figure 2-7
4. Equipment or 27-ft level (Contains two air compressors for building air supply and the recirculation and supply pump for the demineralized water.)

The 1706-KEL Coolant System Development Laboratory is an annex of the 1706-KE facility. The majority of the walls are built of concrete block. The upper levels are of transite panel over steel-frame construction. The roof is constructed of reinforced concrete precast slab. The foundation and floors, at grade and below grade, are constructed of reinforced concrete. The walls extend 20 ft above grade, 20 ft below grade, 100 ft in length and 56 ft in width.

The upper level of the 1706-KER Water Recirculation Studies Building is transite panel over steel-frame construction. The roof is constructed of metal or transite deck. The foundation and floors, at grade and below grade, are constructed of reinforced concrete. The walls are 20 ft in length, 27 ft in width above grade, and 66 ft in width below grade.

Figure 2-5. General Layout 1706-KE Building - 0-ft Level.

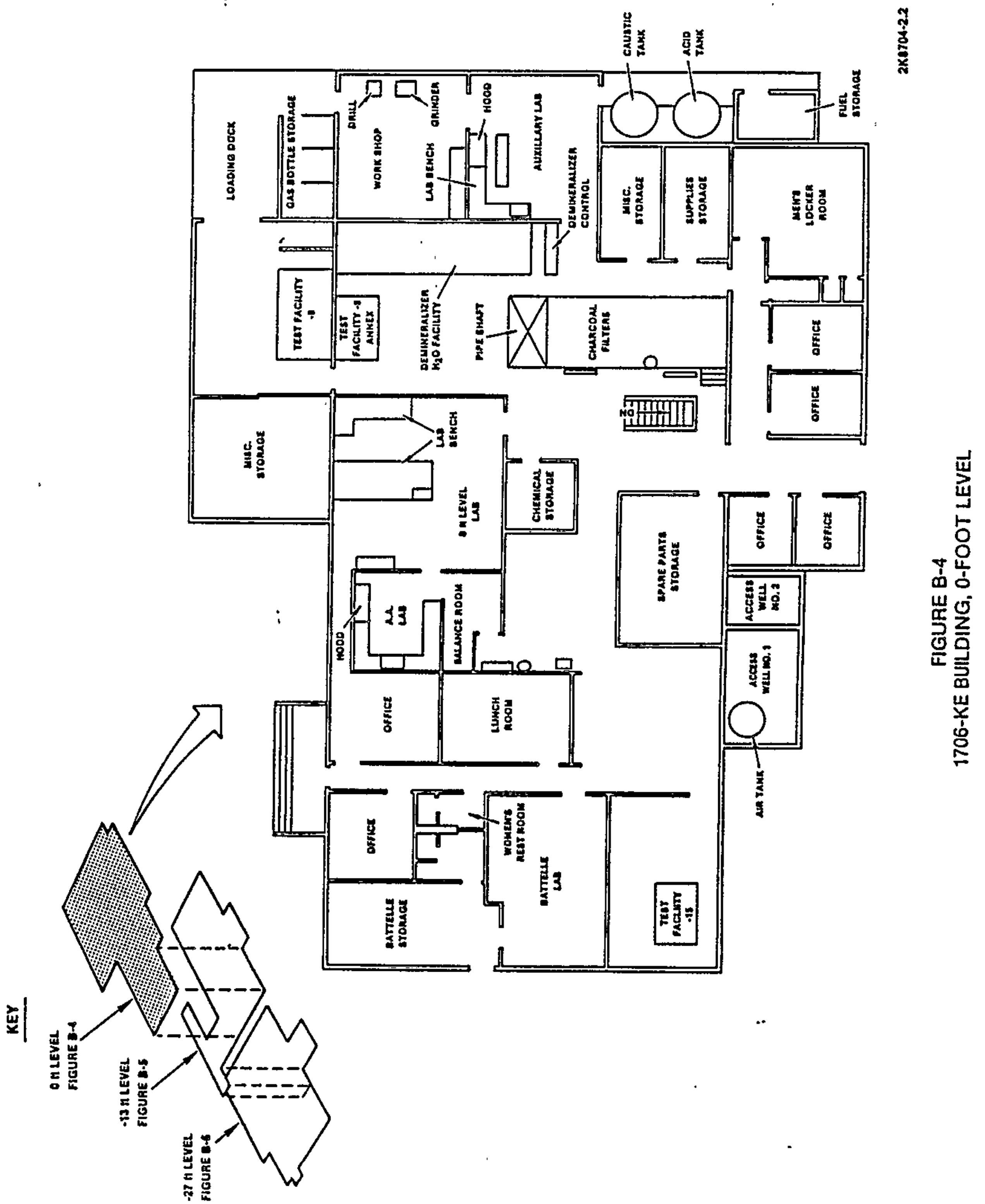


Figure 2-6. General Layout 1706-KE Building - 13-ft Level.

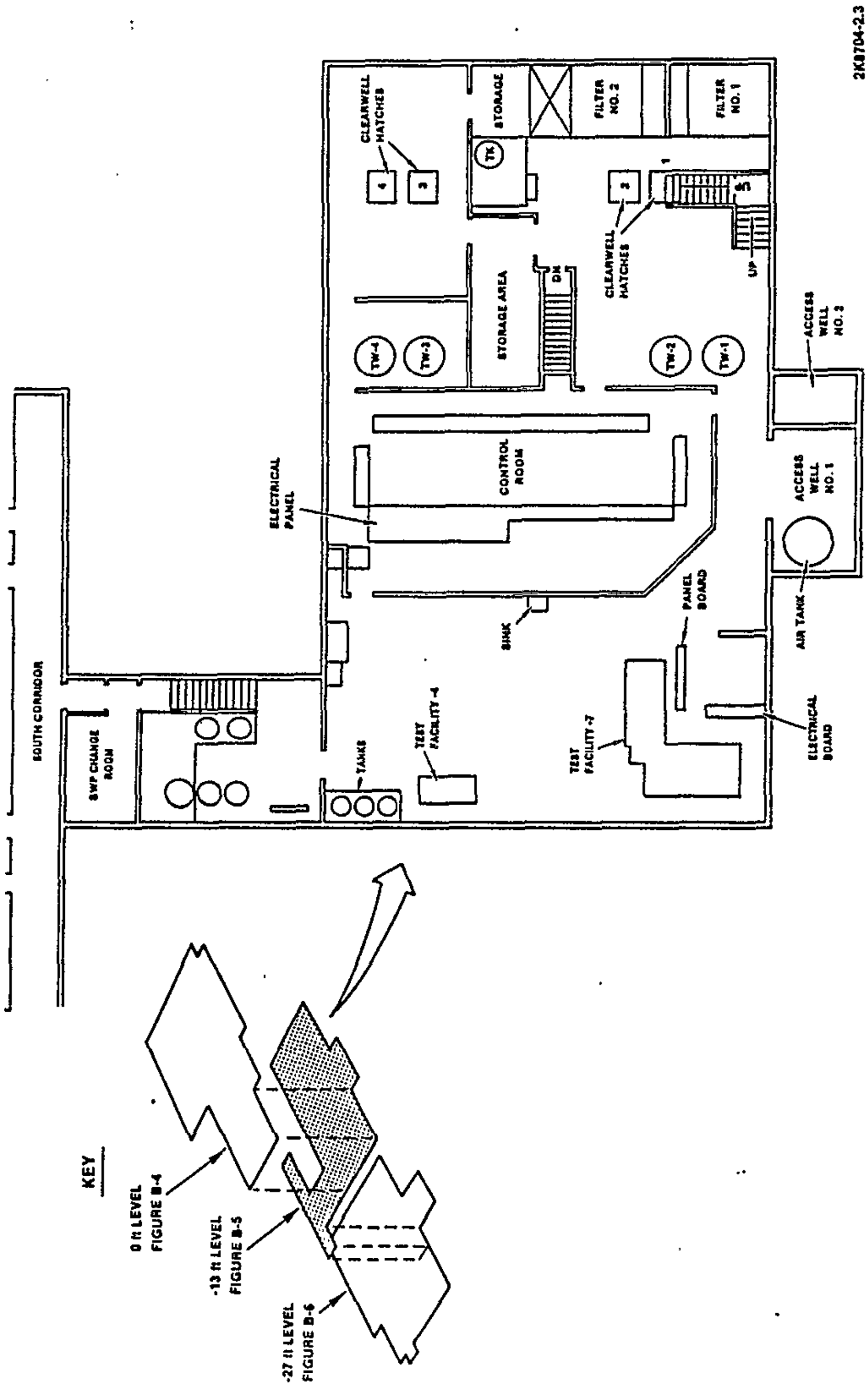
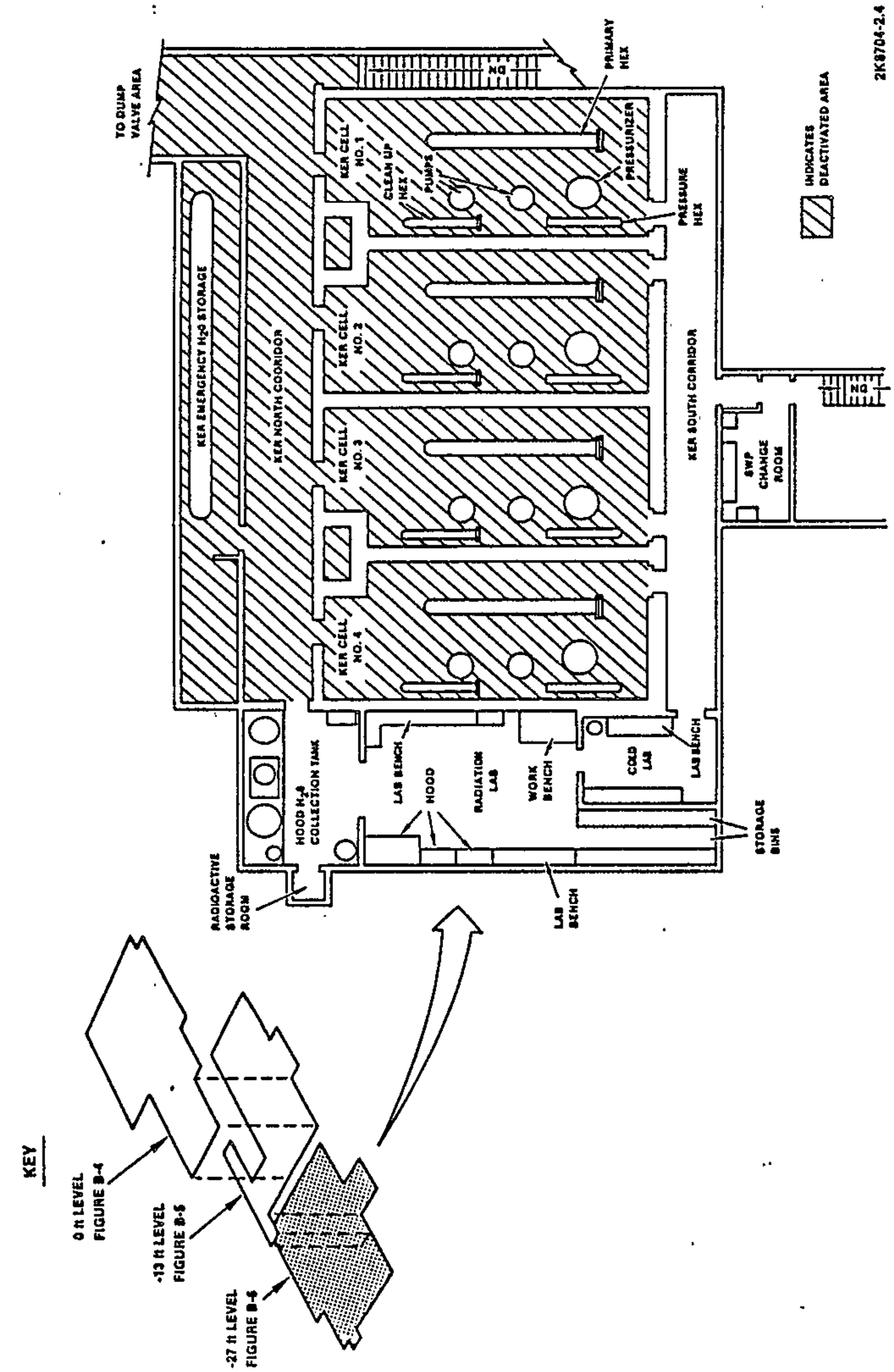


Figure 2-7. General Layout 1706-KE Building - 21-ft Level.



2.1.3 1908-KE Outfall Physical Description

The primary liquid effluent discharge point at the 100-K Area is the 1908-KE outfall. This discharge is permitted as NPDES Outfall 004 (EPA 1981). Cooling water used in the water chiller, which is used to maintain the fuel storage basin water temperature, is discharged through this outfall. It also discharges the regeneration water from the 1706-KE Building ion exchange columns. This outfall discharges liquid to the Columbia River at a rate of approximately 3.7×10^{08} gal/yr.

The outfall itself is a pair of 84-in. dia concrete pipes which extend from the 1908-KE building (approximately 750 ft from the river) and discharges beneath the surface of the Columbia River at one-third of the way across the river. The outfall itself is covered in rip-rap (large stones to strengthen the outfall pipe and protect the pipes from the effects of the current).

2.1.4 181-KE Outfall Physical Description

The 181-KE Outfall is located adjacent to the 181-KE building. The outfall discharges the traveling filter screen backwash water. The outfall is a 12-in. dia pipe. It travels downward from the filter screens into the ground just west of the 181-KE building. The pipe then bends toward the middle of the Columbia River. The discharge is approximately 575 ft toward the center of the channel from the 181-KE Building.

2.2 FACILITY PROCESS DESCRIPTION

2.2.1 Fuel Storage Basins Process Description

The 105-KE and 105-KW Reactors were shut down in February 1970 and February 1971, respectively. Their fuel storage facilities, the 105-KE and 105-KW Basins, provided shielding and cooling for the irradiated fuel during operation. In the mid-1970's and early 1980's, the 105-KE and 105-KW Basins were modified to provide temporary storage of N Reactor fuel until it was processed at the PUREX plant. In 1989 all of the remaining fuel assemblies in the N Reactor fuel storage basin were encapsulated and shipped to the 105-KW Basin.

The N Reactor fuel consists of slightly enriched metallic uranium bonded to a layer of zirconium alloy (Zircaloy-2), hereinafter referred to as the cladding. The cladding provides the primary barrier against the escape of fission products and fissile materials from the fuel assembly. The fuel assembly includes two components: an inner and outer tube-shaped element, assembled into a tube-in-a-tube arrangement. N Reactor fuel differs from commercial reactor fuel in that it is co-extruded and fully bonded to the cladding, thus eliminating the potential for any macroscopic voids between the metallic uranium and the cladding. The oxide fuels used in commercial reactors have such voids which serve as accumulation centers for volatile fission products. Also, because the fuel from N Reactor was exposed to less than half the burnup (megawatt-days) of commercial reactor fuel, the fission product inventory per gram of fuel is proportionally lower.

The fuel stored in the K Basins was discharged from N Reactor between 4 and 21 yr ago, and has had sufficient decay time to essentially eliminate ^{131}I, as well as other short-half-life radionuclides. Upon its discharge, the fuel was allowed to cool for a minimum of 150 days in the N Reactor fuel storage basin. The fuel was then either placed in open-top (MK 0, I,and II) canisters and transported to 105-KE Basin or sealed in (MK I and II) canisters and transported to 105-KW Basin for temporary storage. As a result of the discharge and subsequent handling operations, the cladding integrity was breached. The loss of cladding integrity ranged from a crack to the complete separation of an element (or both elements) into two or more, releasing radioactivity. If the cladding was intact, radionuclides remained in the fuel assembly. However, once the cladding integrity was lost, water gained access to the metallic uranium, starting the corrosion of the metallic uranium and the leaching of radionuclides into the basin cooling water. It has been estimated that about 7% of the fuel currently stored in the 105-KE and 105-KW Basins has ruptured.

The 105-KE Basin currently contains 3,668 open-top canisters filled with N Reactor fuel and two baskets (the equivalent of five canisters) filled with aluminum-clad fuel assemblies from the retired single pass reactors. The fuel was not encapsulated because PUREX operations had been scheduled to process the fuel in the mid-1980's. However, since the primary barrier (cladding) on approximately 7% of the stored fuel had been breached, fission products have escaped from these fuel assemblies, contaminating the basin cooling water. The continuing contamination of the basin cooling water is an environmental concern because the 105-KE Basin has leaked in the past and the basin is located near the Columbia River. The basin has not leaked since it was last repaired in 1980.

Westinghouse Hanford currently plans to encapsulate the fuel currently stored in the 105-KE Basin in sealed canisters to provide a new primary barrier that will eliminate the continuing contamination of the basin cooling water. The basin's water filtration and ion exchange systems will then reduce the current contamination level of the basin cooling water, which will result in reduced levels of radiation exposure to the workers. Once the fuel is encapsulated, the basin cooling water will provide a secondary barrier against the potential release of radioactive materials to the environment.

The 105-KW Basin has not experienced any leaks and currently contains 3,821 sealed (MK I and II) canisters filled primarily with N Reactor fuel. The 1,773 MK I canisters include 777 aluminum canisters and 996 stainless steel canisters. The MK II canisters are made of stainless steel. The MK I and II canister provide the primary barrier for the fission products escaping from the damaged fuel assemblies and the basin cooling water provides a secondary barrier to the potential release of radioactive materials to the environment.

Water levels are maintained in each basin at a minimum of 10 ft above the irradiated fuel to cool the fuel and provide radiological shielding for personnel working in the facility. The water in each basin is recirculated through a closed water-cooling system using mechanical chillers. Filters and ion exchange systems maintain basin water clarity and remove radionuclides. Used filters and spent ion-exchange system components are disposed of at the Hanford 200 Area Low-Level Waste Burial Grounds.

Added ensurance against loss of water is provided by sealing the floor drains in the pool with concrete. Additional protection is provided at KW by coating the walls and floor of the pool with a pliable epoxy sealant. The only escape route for the water from the pool is through overflow weirs located approximately 2.5 ft above the pool water level.

The Operations Safety Requirements (OSR) for the 105-KE/KW Fuel Storage Basins require that the cooling pool water temperature, pH, and depth be monitored. In addition, the effluents from the basins that are discharged to the Columbia River and released to the atmosphere are monitored for radioactivity. The release of liquids containing radioactive materials by way of leakage pathways, discharging to the ground from the 105-KE and KW Fuel Storage Facilities, is monitored by means of basin drawdown testing performed at least once a month.

The 105-KE and KW Fuel Storage Facilities were designed to operate with a maximum water temperature of 38 °C (100 °F). The cooling pool recirculation system consists of recirculation pumps, water chillers, cartridge filters and an ion exchange system. One of the primary functions of this system is to remove the decay heat generated by the irradiated fuel stored in the basin. This is accomplished by circulating the basin water through the water chillers where the heat is transferred to the secondary water system and released to the river. This discharge is permitted by the NPDES permit as Outfall 004 (EPA 1981).

The pool cooling and recirculation system is not completely redundant but does have some redundant equipment (three recirculation pumps, two cartridge filters, and three ion exchange tanks) so that the complete system can be removed from service for short periods of time for equipment repairs or normal maintenance work. Emergency cooling water is available, either from the clear well reservoirs or directly from the Columbia River.

The cooling water shall have a pH between 5.0 and 9.5 for KE and KW Basin. Continuous pool water pH monitoring capability shall be maintained at all times. Maintaining the pH in the ranges specified will result in an acceptable corrosion rate for fuel storage canisters and steel components in the pool cooling and recirculation system. Technology has determined that reducing the minimum pH from 6.5 to 5.0 to accommodate demineralization of the KE Basin, should cause no increase in carbon steel corrosion. KW Basin walls are protected with an epoxy coating and are not subject to significant dissolution.

2.2.2 Engineering Laboratory Process Description

Engineering and Environmental Development Laboratory is located in the 1706-KE-KEL-KER Building at the 100-K Area. The facility was originally designed as a testing complex for single pass and recirculating in-reactor test loops plus numerous prototype out-of-reactor test loops. The loops were designed to permit studying the effects of water quality and decontamination solvents on the corrosion characteristics of reactor hardware and fuel element materials.

With the startup of the N Reactor in 1965 and the shutdown of the KE Reactor in 1971, the facility has been used to perform testing in direct operational support of N Reactor. The testing programs included water QC, corrosion, decontamination, procedure development, waste treatment systems development, ion exchange, evaluations and material testing. Some testing was in support of N Reactor stand-down. The building ion exchanger still supplies demineralized water for the K area fuel storage basins.

The 1706-KE Waste Treatment System is contained on the 27-ft level of the 1706-KE Building. All wastes treated in the system are generated in 1706-KE Building.

2.2.3 1908-KE Outfall Process Description

Effluent to the 1908-KE Outfall originates from two sources. The largest component comes from secondary cooling water for the 105-KE and 105-KW Basins. In addition, filter backwash goes to a setting basin and then, after settling, to the outfall. The only chemicals going to this outfall are a result of water treatment. There is no direct connection between KE and KW Basin water with the secondary cooling water.

2.2.4 181-KE Outfall Process Description

The 181-KE Building is the water supply pumphouse for ongoing operations at the 100-K Area. The facility operates approximately once per week to draw the water needed to support the operation of the basins. The outfall from this facility is the filter screen backwash. This building is equipped with travelling filter screens. These screens remove debris and larger particulates from the river water being drawn into the intakes of the pump building. These screens are periodically backwashed to flush the accumulated debris from the screens. The water used to wash the screens is then returned to the river via the NPDES Outfall 003. There is no possibility of the discharge from this outfall containing radionuclides or contaminants due to operations in the 100-K Area.

2.3 IDENTIFICATION AND CHARACTERIZATION OF POTENTIAL SOURCE TERMS

2.3.1 KE Fuel Storage Basin Source Term

The KE Basin contains approximately 1150 t of irradiated fuel (WHC 1991c).

A source term for KE Basin was calculated using the knowledge of the radionuclide inventory at the end of the fuel cycle, and the fact that the fuel is at least 4 yr old.

As shown in Table 2-1, the inventory in one full reactor load of fuel is approximately 4.11 x 10^{09} Ci (WHC 1990d). This inventory is a conservative approach to the number of curies produced by fission in the reactor. It assumes the entire fuel core is in equilibrium at the end of the fuel cycle; in actuality, only about one-third of the core reaches equilibrium.

To calculate the current KE Basin source term, this inventory was broken down by radionuclide and decayed for 4 yr, using standard radioactivity decay calculations. This inventory was then multiplied by the number of reactor loads of fuel in the basin, giving a current radionuclide inventory in KE Basin, which was calculated to be approximately 8.5 x 10^{06} Ci, as shown in Table 2-1.

Because some of the stored fuel contains approximately 7 to 10% failed fuel cladding and is stored in open canisters, some of the fissions products have migrated into the water environment of the basin. Table 2-2 shows the inventory in the water is approximately 56 Ci (Rokkan 1990a).

2.3.2 KW Fuel Storage Basin Source Term

The KW Basin contains approximately 956 t of fuel (WHC 1991c), which is approximately 2.5 full reactor loads of fuel. By using the knowledge of N Reactor core fission products inventory for a single reactor load of fuel at the end of the fuel cycle, a source term for KW Basin can be calculated by taking into consideration that the fuel at KW has decayed for at least 12 yr, and multiplying the remaining inventory amounts by 2.5.

The methodology used for this calculation was the same as that used for the KE Basin. The resulting inventory obtained for the fuel stored in KW Basin was 3.8 x 10^{06} Ci as shown in Table 2-1. The fuel in the KW Basin is stored in closed aluminum canisters; therefore, only a very small amount of fission products has dissolved into the basin water. For the KW Basin, the amount of radioactivity in the water is about 2.9 Ci as shown in Table 2-2 (Rokkan 1990a).

Table 2-1. Fission Product Inventory in K Area Fuel Storage Basins.

Radionuclide	Activity per Reactor Load[a,e] (Ci)	Half Life (yr)	KE Basin Current Activity[b] (Ci)	KW Basin Current Activity[c] (Ci)
^{85}Kr	1.113 E+05	10.7	2.603 E+05	1.289 E+05
^{85m}Kr	4.271 E+07	0.0005137	0	0
^{87}Kr	8.229 E+07	0.00014517	0	0
^{88}Kr	1.164 E+08	0.00031963	0	0
^{86}Rb	8.564 E+03	0.05123288	0	0
^{89}Sr	9.672 E+07	0.13835616	0	0
^{90}Sr	9.170 E+05	28.8	2.524 E+06	1.731 E+06
^{91}Sr	1.927 E+08	0.00108447	0	0
^{90}Y	8.906 E+05	0.00732877	0	0
^{91}Y	1.095 E+08	0.16164384	1.184 E+01	0
^{95}Zr	1.138 E+08	0.17808219	5.990 E+01	0
^{97}Zr	2.033 E+08	0.00194064	0	0
^{95}Nb	5.865 E+07	0.09863014	0	0
^{99}Mo	2.109 E+08	0.00753425	0	0
^{99m}Tc	1.820 E+08	0.00068493	0	0
^{103}Ru	8.103 E+07	0.10794521	0	0
^{105}Ru	4.933 E+07	0.00049543	0	0
^{106}Ru	2.431 E+06	1.00547945	4.677 E+05	1.568 E+03
^{105}Rh	4.261 E+07	0.00410959	0	0
^{127}Sb	5.564 E+06	0.01068493	0	0
^{129}Sb	2.448 E+07	0.0005137	0	0
^{127}Te	4.830 E+06	0.28767123	9.562 E+02	0
^{127m}Te	2.700 E+05	0.00106164	0	0
^{129}Te	2.200 E+07	0.09315068	0	0
^{129m}Te	4.607 E+05	0.00012747	0	0
^{131m}Te	1.340 E+07	4.7565E-05	0	0
^{132}Te	1.483 E+08	0.00890411	0	0
^{131}I	9.979 E+07	0.02191781	0	0

Table 2-1. Fission Product Inventory in K Area Fuel Storage Basins.

Radionuclide	Activity per Reactor Load[a,e] (Ci)	Half Life (yr)	KE Basin Current Activity[b] (Ci)	KW Basin Current Activity[c] (Ci)
^{132}I	1.493 E+08	0.00026256	0	0
^{133}I	2.340 E+08	0.00238584	0	0
^{134}I	2.613 E+08	0.00010084	0	0
^{135}I	2.184 E+08	0.06917808	0	0
^{133}Xe	2.332 E+08	0.01438356	0	0
^{135}Xe	3.641 E+07	0.00103881	0	0
^{134}Cs	3.853 E+04	2.1	3.119 E+04	1.851 E+03
^{136}Cs	4.710 E+05	0.03561644	0	0
^{137}Cs	9.395 E+05	30	2.595 E+06	1.794 E+06
^{140}Ba	2.103 E+08	0.03506849	0	0
^{140}La	2.103 E+08	0.00460046	0	0
^{141}Ce	1.548 E+08	0.0890411	0	0
^{143}Ce	2.011 E+08	0.00376712	0	0
^{144}Ce	2.864 E+07	0.77808219	2.461 E+06	1.647 E+03
^{143}Pr	1.946 E+08	0.03753425	0	0
^{147}Nd	6.670 E+07	0.03041096	0	0
^{239}Pu	5.380 E+04	24360	1.630 E+05	1.355 E+05
TOTAL(Ci)	4.11 E+09		8.50 E+06	3.80 E+06

Source: Westinghouse Hanford (1990e)

[a]At end of cycle.
[b]KE Basin contains approximately 3.03 reactor loads[d] of fuel aged 4 yr.
[c]KW Basin contains approximately 2.52 reactor loads[d] of fuel aged 12 yr.
[d]Fuel quantities from K Basin Accountability Records.
[e]Westinghouse Hanford (1990d)

Table 2-2. Fission Product Inventory in KE/KW Storage Basin Water.

KE/KW Basin Radionuclide	KE Basin Water (Ci)	KW Basin Water (Ci)
^{3}H	2.1 E+01	7.9 E-01
^{54}Mn	6.2 E-02	9.1 E-04
^{60}Co	4.7 E-02	2.2 E-03
^{90}Sr	1.5 E+01	1.8 E+00
^{125}Sb	1.5 E-01	NA
^{134}Cs	6.8 E-02	5.0 E-03
^{137}Cs	1.9 E+01	3.5 E-01
^{238}Pu	1.6 E-02	9.7 E-06
^{239}Pu	9.1 E-02	5.0 E-05
Total	5.6 E+01	2.9 E+00

Source: Rokkan (1990a)

2.3.3 Potential Nonradioactive Source Terms

Hazardous process chemicals currently stored on site at 100-K Area are listed in Table 2-3. The potential for their release via the airborne or liquid effluent pathway has been reviewed. This review has determined that there is insignificant potential for these chemicals to be released via any of the effluent release points.

The potential nonradioactive hazardous air pollutants that were considered in the Operational FEMP Determination for 100-K Area were those listed in EPA 40 CFR Part 61.01(a) and 40 CFR Part 61.01(b) (EPA 1989c). It was determined, after a thorough review of the 105-KE/KW operating facilities, that none of the chemicals listed in either 40 CFR Part 61.01(a) or (b), with the exception of radionuclides, are present in the airborne releases from 105-KE or KW. Therefore, radionuclides are the only hazardous air pollutant considered in this FEMP.

For the 105-KE and KW operating facilities, the single liquid release point to the Columbia River was reviewed to determine the potential to release hazardous waste. The 1908-KE Outfall and 181-KE Outfall are permitted as NPDES outfalls and the analysis performed on these outfalls for the permit does not indicate any release of hazardous waste.

There are no other hazardous waste materials released by KE and KW operating facilities via either the air emissions pathway or the liquid effluent pathway. Hazardous materials are stored at 100-K Area; however, thorough review has shown that there is little potential for their release to the effluents from KE or KW.

Table 2-3. Process Chemicals Stored at KE/KW (1990).

Chemical Stored	Pounds Stored	Pounds Released	Building Location
Sodium Hypochlorite	120	NR[a]	165-KW
Chlorine	6,000	NR	183-KE
Polyacrylamide	50	NR	183-KE
Sodium Hydroxide	18,970	NR	1706-KE
Sulfuric Acid	31,681	NR	1706-KE

[a]None Released

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3.0 APPLICABLE REGULATIONS

The DOE, EPA and Washington State have issued orders, regulations and guidance on the monitoring of effluents. The following sections are intended to be only a brief summary of the requirements for effluent monitoring. To ensure full compliance with the regulations and industry guidance, the specific regulation or guidance document should be consulted. Westinghouse Hanford is currently reviewing this FEMP for compliance to applicable regulations and comments will be incorporated into future revisions. This review will be complete by January 1, 1992.

3.1 DOE ORDER 5400 SERIES REQUIREMENTS FOR A FACILITY EFFLUENT MONITORING PLAN

The DOE has issued two orders for the monitoring and reporting of effluents from its facilities. The two orders that have been issued are DOE 5400.1, *General Environmental Protection Program* (DOE 1988a) and DOE 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1990b). In addition to these two orders, DOE has also published the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T (DOE 1991). The following is a summary of those orders; however, for compliance purposes the full unabbreviated DOE order must be consulted.

3.1.1 DOE 5400.1 General Environmental Protection Program

DOE 5400.1, *General Environmental Protection Program,* was written with the express purpose of ensuring compliance with the applicable federal, state and local environmental protection laws and regulations, executive orders and internal departmental policies.

The *General Environmental Protection Program* in Chapter II, Parts 4 and 5, requires an annual site environmental report and a report on radioactive effluents, onsite discharges and unplanned releases. The order states that the environmental report is to contain the radiological information on radioactive effluent data, environmental sampling for radioactivity and reporting on the potential doses to the public. The annual report should also contain nonradiological program information from effluent data and environmental sampling from nonradiological pollution. The report must also contain information on groundwater monitoring and QA.

Chapter III of DOE Order 5400.1 requires RL to develop specific environmental protection programs for each facility or group of facilities. The plans must provide the environmental protection goals and objectives for complying with the environmental laws and/or regulations.

Chapter IV requires an environmental monitoring program for measuring and monitoring effluents from DOE operations and for surveillance through measurement, monitoring and calculation of the effects on the public and the environment. Since each DOE facility is unique, the specific environmental monitoring program shall be determined for each facility on a case by case basis, consistent with regulatory requirements, DOE directives and the degree of environmental ensurance that is required at a particular site.

Part 4 of Chapter IV requires an environmental monitoring plan for each site, facility or process that uses, generates or releases significant pollutants or hazardous material. Part 5 of this Chapter identifies the general requirements for effluent monitoring to be conducted and the general program objectives to be achieved to verify compliance with applicable DOE orders and federal, state, and local regulations.

Part 6 of Chapter IV requires a meteorological monitoring program to support the environmental monitoring program activities. This required program is currently conducted by Pacific Northwest Laboratories (PNL).

Part 7 of Chapter IV requires that radiation and radioactive materials discharged from DOE facilities comply with the requirements of 40 CFR Part 61, *National Emission Standards for Hazardous Air Pollutants* (NESHAP) (EPA 1989c). For those radioactive materials not regulated under the *Clean Air Act of 1977* (CAA), DOE has established standards under the Atomic Energy Act.

Part 8 of Chapter IV requires nonradiological monitoring for air emissions monitoring under Section 118 of the CAA which specifically addresses the control of airborne pollution from federal facilities. An ambient air quality monitoring may be required during operation but not during standby to determine the highest concentrations where public health or other concerns should be considered.

The monitoring of liquid effluents is required under the *Clean Water Act of 1977* (CWA) under Section 402, entitled NPDES Program. In addition to the NPDES permitted facilities, DOE must satisfy monitoring requirements under RCRA and the applicable regulations under 40 CFR Part 260-280 and Washington State under WAC 173-303 (WAC 1989).

Part 9 of Chapter IV requires a groundwater monitoring plan be developed and implemented for DOE activities that do affect or have the potential to affect groundwater quality. Part 10 of Chapter IV requires a QA program consistent with DOE 5700.6B (DOE 1986a) and an independent data verification program.

DOE 5400.1 states that the monitoring of nonradiological liquid effluents comes under the requirements of the CWA for NPDES permits and under RCRA for the monitoring of solid waste, which can be a liquid, under 40 CFR Part 260-280 and/or WAC 173-303 *Dangerous Waste Regulations*.

3.1.2 DOE Order 5400.5 Radiation Protection of the Public and the Environment

The purpose of DOE 5400.5 (DOE 1990b) is to establish the standards and requirements for facility operations with respect to protection of the members of the public and the environment against undue risk.

Chapter I, Part 5a limits the radiation dose to members of the public to the primary radiation standards established in DOE Order 5400.5, to the applicable limit of EPA and Washington State regulations, and to additional controls on the release of liquid wastes set by DOE to reduce the potential of radioactive contamination to natural resources, such as land, ground and surface water, and ecosystems.

Chapter I, Parts 8a and 8b, of DOE Order 5400.5, requires a demonstration of compliance based on calculations that make use of the information obtained from monitoring and surveillance. The ability to detect, quantify, and adequately respond to the unplanned release of radioactive material to the environment also relies on the in place effluent monitoring, monitoring of the environmental transport and diffusion conditions and assessment capabilities. DOE requires analysis of the collected data, analysis of the pertinent information, and a report on any release in a timely manner.

Chapter I, Part 10 of DOE Order 5400.5 requires that calculations of dose to the public from exposures resulting from both routine and unplanned activities be performed by the use of standard EPA and DOE dose conversion factors or analytical models prescribed in the applicable regulations.

The dose models used for the dose calculations performed for the 100-K Area Fuel Storage Basins used the PNL dose models known as GENII (Napier et al 1988) and the EPA model known as CAP-88 (Beres 1990).

Chapter II sets the radiation dose limits for the public and the environment at 100 mrem/yr. The public dose limits do not apply to medical exposure, consumer products, and generally do not apply to naturally occurring radiation sources or from accidents where exposure may be different or does not apply.

It is the policy of DOE to provide a level of protection for persons consuming water from a public drinking water system to meet the standards in 40 CFR Part 141 (EPA 1987b). These systems shall not cause persons consuming water to receive an effective dose of greater than 4 mrem in a single year.

DOE 5400.5 (DOE 1990b) requires that field elements develop an ALARA program to minimize the dose to the public that also considers maximum dose to the public, collective dose to the population, alternative processes, costs and impacts on society.

Part 6 of Chapter II of DOE order 5400.5 requires that the radiation dose limit for a member of the public be demonstrated by measurements and calculations to evaluate the potential doses.

Subpart a of Part 6, Chapter II has the general requirement for effluent monitoring as part of the environmental monitoring plan prescribed in DOE Order 5400.1 (DOE 1988a). The specific requirement for radiological monitoring, effluent monitoring and environmental surveillance and their respective schedules of implementation are prescribed in the DOE 5400 series of orders which deals with radiological effluent monitoring and environmental surveillance.

Part 8 of Chapter II identifies the reporting and recordkeeping requirements of DOE 5400.1 (DOE 1988a) and DOE 5484.1 (DOE 1983). These require the notification of the relevant program office and the deputy assistant secretary for environment of the actual or the potential exposures of members of the public that could result in an EDE of greater than 10 mrem in a year or not meeting any other requirement specified in the order or any other legally applicable limit.

3.1.3 Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, DOE/EH-0173T

The purpose of the regulatory guide is to specify the necessary elements for effluent monitoring and environmental surveillance of radioactive materials at DOE facilities for compliance with both applicable federal regulations and DOE policy (DOE-RL 1989).

Section 1.1.1 requires that all DOE sites develop and maintain documentation concerning their environmental protection plans in the form of environmental monitoring plans. These required plans should clearly describe how the minimum requirements defined in the document are to be met and how the compliance will be ensured.

Section 2.0, which covers liquid effluent monitoring, states that all liquid effluent streams from DOE facilities should be evaluated and their potential for release of radionuclides should be assessed. The results of the assessment should provide the basis for the FEMP including the following:

- Effluent monitoring locations used for providing the quantitative effluent release data for each outfall
- Procedures and equipment used to perform the extraction and measurement
- Frequency and analysis required for each extraction and or sampling location
- Minimum detection level and accuracy
- QA components
- Effluent outfall alarm settings and bases.

Section 2.2 recommends that the system performance consider the following.

- The selection or modification of a liquid effluent monitoring system should be based on a careful characterization of the sources, pollutants, sample collection system, and final release points.
- The standard further recommends that for continuous effluent monitoring/sampling, all the data received should be used when performing statistical analyses.

- When it is not technically feasible to monitor continuously, continuous proportional sampling and analyses can be used as an alternative to continuous monitoring.

- Continuous monitoring and sampling systems should be calibrated before use, and recalibrated any time they are subject to maintenance, modification or system changes that may affect equipment calibration. As a minimum, the system should be recalibrated annually and checked routinely with known sources to demonstrate that the system is functioning properly.

The general design criteria that should be considered when operating a liquid effluent sampling system are:

- The location of the sampling and monitoring systems

- The use of a pump in areas where necessary to provide a uniform continuous flow in the main sample line

- A redundant sample collection system (with one of the following alternatives) that permits continued sampling during replacement or servicing:

  - Substitute sample transport system
  - Capability for rapid shutdown for repairs
  - An alternate method for estimating releases when the system does not operate
  - Location of sample ports sufficiently stream and stream line flows with an accuracy of at least ± 10 percent.

- Design the system to minimize sedimentation and prevent the sample effluent lines from freezing.

There are also special liquid monitoring conditions that should be considered when they appear, such as:

- Recirculating tank lines to ensure representative sample
- Sedimentation or sludge formation
- Adequate mixing.

Section 3.0, which covers airborne effluent monitoring requires that all airborne emissions from DOE facilities be evaluated and their potential for release be assessed and evaluated. The results of the evaluation should provide the basis for the site's airborne EMP to show, as with the liquid effluent monitoring, effluent monitoring extraction locations, procedures and equipment, frequency and analyses, minimum detection level and accuracy, QA concerns and investigations and alarm levels.

The criteria listed in Regulation Guide Table, Table 3-1, are to be used to establish the airborne emission monitoring program for DOE controlled sites. The criteria listed in Table 3-1 are based on the projected EDE in 1 yr to a member of the public in mrem. The guidance states that the airborne monitoring program should be commensurate with the importance of the sources during routine operation and from potential accidents with respect to their contribution to the public dose or contamination to the environment.

The performance characteristics of the air emissions monitoring are similar to the liquid effluent monitoring system where calibration, instrument function, instrument limits and alarm settings are being considered.

The sources contributing to the total emissions from a facility can be considered to be either point sources or diffuse sources. A point source is the release of material through a vent or stack; a diffuse source is an area source released from many points or areas.

Section 3.4, Design Criteria for System Components, requires that air emission monitoring systems demonstrate that the quantification of airborne emissions is timely, representative, and adequately sensitive. The factors that are important to consider in airborne emissions monitoring are the identification of:

- The actual and/or potential radionuclides present
- Fallout and naturally occurring background
- Chemicals or materials that could adversely affect the sampling and monitoring system
- Environmental conditions that could adversely affect the system, such as humidity, temperature, radiation field and/or loss of the system from electrical failure or fire
- Process variability
- Particle size
- Radionuclide distribution.

Section 3.5 of the regulatory guidance identifies the guidance for monitoring radioactive material in gas-streams. The guidance recommends that the EPA methods for stack monitoring be used. These methods are Method 1, 2, and 4 to measure and determine stack velocity, static pressure, temperature and moisture content. The guidance identifies the following parameters that are important in gas sampling:

- Location of sample extraction sites
- Types of sample extraction probes
- Sample transport lines
- Air moving systems
- Air flow systems
- Air flow measurements
- Sample collectors
- Continuous monitoring systems.

The guidance also discusses specific types of monitors such as tritium monitors, ionization chambers, radioiodine monitors, noble gas monitors, particulate monitors, transuranic monitors, and uranium monitors.

The guidance document also discusses the QA requirements of effluent monitoring.

Table 3-1. Regulation Guide Table.

Calculated Maximum Dose From emissions in a year to Members of the Public effective dose equivalent (H_E) mrem	Minimum Emission Monitoring Criteria[a]
$H_E \geq 1$	(1) Continuously monitor emission points that could contribute ≥0.1 mrem/yr.
	(2) Identify radionuclides that contribute ≥10% of the dose.
	(3) Determine accuracy of results (±% accuracy and % confidence level).
	(4) Conduct a confirmatory environmental survey annually.
	or Monitor at the receptor:
	(1) Continuously sample air at the receptor.
	(2) Collect and measure radionuclides contributing ≥1 mrem (EDE) above background.
	(3) Establish sampler density sufficient to estimate dose to critical receptor given typical variability of meteorological conditions.
	(4) Obtain prior approval from EPA.
$0.1 < H_E < 1$	(1) Continuously monitor emission points that could contribute ≥0.1 mrem/yr.
	(2) Identify radionuclides that contribute 10% or more of the dose.
	(3) Conduct confirmatory effluent monitoring at emission points where possible.
	(4) Conduct a confirmatory environmental survey every few years.
$H_E < 0.1$	(1) Take periodic confirmatory measurement.
	(2) Test to determine need to monitor by calculating dose (H_E) for normal operation, assuming that the emission controls are inoperative.
	(3) Conduct a confirmatory environmental survey at least every 5 yr.

Source: DOE (1991)

[a]Permission for the use of alternative criteria may be obtained through Environmental Health, who will coordinate the request with EPA Headquarters to obtain EPA concurrence, where applicable. Coordination with EPA Regional Offices should be accomplished through DOE Program Office authority.

The preceding summary of effluent monitoring is only a synopsis of the material that is present. The full document should be consulted for a thorough understanding of its recommendations.

3.2 U.S. ENVIRONMENTAL PROTECTION AGENCY REGULATORY REQUIREMENTS FOR EFFLUENT MONITORING

3.2.1 U.S. Environmental Protection Agency Subpart H - National Emission Standards for Radionuclide Emissions from DOE Facilities under 40 CFR Part 61

Air emission monitoring and reporting is required for the 100-K Area Fuel Storage Basins under 40 CFR Part 61 Subpart H, "National Emissions Standards for Emission of Radionuclides from DOE Facilities" (EPA 1989c). The standard requires that "Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an EDE of 10 mrem/yr."

Section 61.93 requires the 100-K Area Fuel Storage Basins to determine compliance with the standard, to determine radionuclide emission, and to calculate the EDE values to members of the public using EPA approved sampling procedures and computer models CAP-88 (Beres 1990) or AIRDOS-PC (Moore et al 1979).

Effluent flow rate measurements shall be made by using Reference Method 2 in Appendix A, Part 60 for stacks and large vents. Reference Method 2A in Appendix A, Part 60, is to be used for pipes and small vents.

Monitoring or sampling sites shall be selected according to Reference Method 1 of Appendix A, Part 60.

Effluent streams shall be directly monitored continuously with an in-line detector, or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance presented in American National Standard Institute (ANSI) 13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities* (ANSI 1969).

Subpart H also requires emissions monitoring, compliance procedures and reporting of the highest EDE to any member of the public offsite at a residence, school, business or office.

Complete details of this important EPA regulation can be found in 40 CFR Subpart H 61.90-61.96.

3.2.2 U.S. Environmental Protection Agency National Pollutant Discharge Elimination System Permit Requirements under 40 CFR Part 423

The monitoring of nonradioactive liquid effluents from 100-K is required by the CWA under NPDES in 40 CFR Part 423, *Steam Electric Power Generating*

Point Source Category (EPA 1990d). The requirements for the NPDES permit are in the permit itself and contained in 40 CFR Part 423.

3.2.3 U.S. Environmental Protection Agency Reportable Quantities under 40 CFR Part 302

The *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) identifies the reportable quantities for hazardous substances and sets forth the notification requirements for the release of these substances. This regulation also sets forth reportable quantities for hazardous substances designated under section 311(b)(2)(A) of the CWA.

3.3 WASHINGTON STATE REGULATORY REQUIREMENTS

The State of Washington has regulatory requirements for the emission of radionuclides under the *Ambient Air Quality Standard and Emission Limits for Radionuclides*, WAC-173-480 (WAC 1986). The state also has regulatory authority for water quality standards for groundwater under WAC-173-200 (WAC 1988) and has regulatory authority for hazardous wastes in its *Dangerous Waste Regulations*, WAC-173-303 (WAC 1989).

3.3.1 Ambient Air Quality Standard and Emission Limits for Radionuclides under WAC 173-480

The purpose of this administrative rule is to define the maximum allowable levels of radionuclides in the ambient air and to control emissions from specific sources (WAC 1986).

The emissions of radionuclides in the air shall not cause a maximum accumulated dose equivalent of more than 25 mrem/yr to the whole body or 75 mrem/yr to the critical organ of any member of the public. At a minimum, all radionuclide emissions must meet the requirements under WAC 173-480-040, which requires every reasonable effort to maintain effluents to unrestricted areas ALARA, as defined under reasonable available control technology (RACT).

The most significant portion of the radionuclide emission rules in WAC 173-480-060, pertaining to the Hanford Site, is WAC 173-480-060. This rule states that any addition, enlargement, modification, replacement, or alteration of any process or emission unit, or the replacement of air pollution control equipment, which will significantly change potential radionuclide emissions or significantly change the dose equivalent, will require the proposed project to use the best available radionuclide control technology.

WAC 173-480-070, "Emission Monitoring and Compliance Procedures," requires that the dose equivalents to members of the public shall be calculated using the Department of Social and Health Services (DSHS) approved sampling procedures, DSHS approved models or other approved procedures.

Compliance with this standard shall be determined by calculating the dose to members of the public at a point of maximum annual air concentrations in an unrestricted area where a member of the public may be located.

3.3.2 Water Quality Standards for Groundwater under WAC 173-200

The state of Washington standards for groundwater applies to all groundwaters that occur in a saturated zone or stratum beneath the surface of land or below a body of surface water (WAC 1987). The goal of the state's regulations is to maintain the highest quality of the state's groundwater and protect it for existing and future use.

Under WAC 173-200-040, the state has developed maximum contaminant concentrations for the protection of the groundwater for a variety of beneficial uses. The state has determined that drinking water is the beneficial use generally requiring the highest quality of groundwater.

Groundwater concentration limits shall not exceed the numeric limits for specific constituents that are found in WAC 173-200-050, Table 1, Groundwater Quality Criteria.

3.4 BENTON-FRANKLIN-WALLA WALLA COUNTIES AIR POLLUTION CONTROL AUTHORITY

3.4.1 General Regulation

Pursuant to the provisions of the Washington Clean Air Act, the Board of Directors of the Benton-Franklin-Walla Walla Counties Air Pollution Control Authority (APCA) is empowered to adopt, amend, and repeal its own ordinances, resolutions or rules and regulations in implementing the provisions of the Revised Code of Washington (RCW) 70.94, and declares these regulations necessary for the health, safety and welfare of the people of Benton, Franklin, and Walla Walla Counties (RCW 1974).

3.5 INDUSTRY STANDARDS UNDER AMERICAN NATIONAL STANDARDS INSTITUTE

3.5.1 ANSI N13.1-1969 Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities

3.5.1.1 American National Standards Institute Standard Objectives. The primary objective for sampling airborne radioactivity in effluents is to measure the release of radioactive materials to the environment (ANSI 1969). This is accomplished through sampling near the point of release.

The objective of ANSI N13.1-1969 is to set forth the principles which apply in obtaining valid samples of airborne radioactive materials and to prescribe acceptable methods and materials for gaseous and particulate sampling.

ANSI N13.1-1969 is limited to the collection of samples and does not address the measurement of the radioactive materials collected. The exclusion of radiochemical measurement from the scope must not be construed to mean that the measurement of samples is of lesser importance than sampling.

3.5.1.2 Sampling Representative According to Spatial Location.

3.5.1.2.1 Sampling from a Duct or Exhaust Stack. The sampling point should be a minimum of five diameters downstream from abrupt changes in flow direction or prominent transitions.

3.5.1.2.2 Sampling without Differentiation or Bias as to Particle Size or Kind. A valid sample must have the same radiochemical and physical composition as the air which would be contacted by the workers in the area to be sampled. Filters used as collectors directly in the air sampled will yield a representative sample for very small particles.

However, the delivery line through which the sample is carried to the collection device will preferentially remove large particles either through gravitational settling or through turbulent impaction when the flow is too high.

3.5.1.2.3 Particle Size Fractionation Due to Isokinetic Sampling. ANSI N13.1 recommends that the sampler arrangement be designed to permit near isokinetic flow into the sampler probe entry.

3.5.1.2.4 Sample Distortion Due to Chemical or Related Effects. Extreme care must be exercised in extracting a sample from an airstream when the sample contains chemically reactive forms of radioisotopes. Reactive vapors such as radioiodine may be largely absorbed on, or react with materials which might be used for sample delivery lines. Materials to be avoided for the sampling of iodine are rubber, copper, and some plastics.

When the air is near the saturation point with water vapor, condensation may occur on the collector itself reducing the amount of sample being carried to the collector.

All the possible interactions that may change the sample quality or quantity should be considered. The chemical form as well as the physical nature of the airborne constituents to be sampled must be known before a representative sample can be ensured.

3.5.1.3 Sample Programming. Many factors enter into the design of a sampling program. The sampling program includes the sample size, frequency of sampling, sample duration, and rate of sampling. In most cases the selection will be a compromise between the ideal and the economically achievable.

3.5.1.4 Sample Sensitivity of Detection and Measurement. The sensitivity and accuracy of the analytical method will determine the minimum volume of air which must be obtained to reach the requisite accuracy and precision.

3.5.1.5 Permissible Levels at the Point of Sampling. The concentration of the radioisotopes of interest will also determine the minimum volume to be sampled.

3.5.1.6 Radioactive Decay. The radioactive half-life of the radionuclide to be measured is an important consideration. For a short half-life, the sampling period may be brief with a large volume throughput and prompt measurement. Also, the equilibrium should be taken into consideration where required. Long lived radioisotopes may require large samples due to their low activity per unit mass.

3.5.1.7 Natural Radioactive Materials. The presence of natural radioactive material may mask the presence of significant quantities of longer lived material requiring delays between sample collection and sample counting.

3.5.1.8 Specific Nature of the Operation or Process. The potential for the release of radioactive material and the consequences of accidental air contamination must be considered in establishing frequency and duration of sampling.

When the purpose of the sampling is to establish the total release of radioactive materials in the environment, the sampling must be designed to ensure an adequate sample during accidental releases. Under normal operations, intermittent or relatively infrequent sampling may be adequate, but when consideration of accidental release potential is made, it may be necessary to monitor continuously.

3.5.2 ANSI N42.18-1980 Specification and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents

3.5.2.1 Introduction and Scope. The objective of continuously monitoring instrumentation is to measure the quantity, and/or the rate of release of radionuclides in the effluent stream and to provide useful documentation for scientific and legal purposes (ANSI 1980).

This standard applies to continuous monitors that measure normal releases, detect inadvertent releases, show general trends, and annunciate radiation levels that have exceeded predetermined values.

This standard specifies detection capabilities, physical operating limits, reliability, and calibration requirements and sets forth minimum performance requirements for effluent monitoring.

3.5.2.2 Factors Affecting Continuous Monitoring.

- The radiological characteristics of the effluent stream may affect the continuous monitoring instrumentation.

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- The physical characteristics of the stream may affect the continuous monitoring instrumentation.

- The chemical characteristics of the effluent stream may affect the continuous monitoring instrumentation.

3.5.2.3 Environmental Factors Must be Taken into Consideration.

- **Effects of Temperature.** Both the detector and the electronic portions of an effluent monitoring system may be influenced by temperature variations. The effects may vary from minor calibration shifts to severe degradation of performance.

- **Mechanical Effects.** Mechanical effects such as shock, vibration, pressure, and noise may adversely affect the system operation. Instruments should be located where these effects can be minimized.

- **Chemical Effects.** Monitors should not be located in areas where airborne chemicals may have an affect on the instrument. Chemical attack on the instrument can lead to deterioration and failure of the electrical components.

- **Effects of Ionizing Radiation.** The ambient level of ionizing radiation even below the limits set to protect personnel may have an adverse affect on the effluent monitoring system. While the detector is not the most sensitive element, certain circuits or components may be affected by the radiation. These effects should be minimized by shielding, anticoincidence, or other compensation techniques.

- **Effects of Humidity.** High humidity can result in measurement error, and in some cases, hydroscopic materials used in detectors may be affected.

- **Effects of Other Factors.** Power variations, power transients, high current contact enclosures and some magnetic and radio frequencies may affect or damage the equipment.

3.5.2.4 Standards, Regulations, and Calibration.

3.5.2.4.1 Standards and Regulations. Effluent monitoring systems must be selected to aid in the determination of compliance with regulatory requirements.

3.5.2.4.2 Calibration. The ease of calibration and calibration stability are important factors affecting the selection of a monitoring system.

3.5.2.5 Effluent Monitoring Systems. Effluent monitors are classified according to the location of the detector with respect to the effluent stream. When the detector is immersed in or directly monitors the stream it is categorized as an in or on line monitor. If a portion of the effluent stream is diverted to the monitor through a bypass loop then the monitor is classified as an off line monitor.

3.5.2.5.1 In-Line Monitoring Systems. In-line monitoring systems are those systems that look directly at the effluent stream and require no external fluid mover or sampling line. In-line systems are useful in determining the gross activity of an effluent stream.

3.5.2.5.2 Off-Line Monitoring Systems. Off-line monitoring systems are more complex and invariably raise the concern over whether the sample or stream is representative. Off-line sampling systems offer the ability to remove the instrumentation to a low background area making it easier to maintain the instrument.

3.5.2.5.3 Detection Capabilities. Detection capabilities to consider are the following.

- **Type of Radiation.** The monitoring instrumentation should take into consideration the type of radiation the instrument will encounter, for example alpha, beta, and/or gamma, and the appropriate energy range of the radionuclide being measured.

- **Range of Detection.** The monitoring system should identify the range that the instrument will identify the radionuclide in concentration units from the minimum to maximum values for a given flow.

- **Instrument Sensitivity.** The minimum and maximum sensitivity for a instrument should be given in terms of the smallest and largest concentration that the instrument can determine, given the conditions and background radiation in which the instrument is set up.

- **Instrument Accuracy.** The accuracy of the instrument should be known for several different radioisotopes and their mixtures. Accuracy is normally stated as percentage of full scale or percentage of the actual reading for that scale.

- **Instrument Precision.** The precision of the instrument is normally given as a percentage deviation up and down the scale from the mean reading at the 95% confidence level for a mid scale reading.

- **Instrument Response Time.** The electronic time constant of the system should be known with the buildup coordinate expressed in terms of percentages for the system response to nuclides in equilibrium deposited on the filter paper.

3.5.2.6 Standards of Performance. The effluent monitoring system for identifying the concentration of radioactive effluents should meet the standards of ANSI N42.18.

3.5.2.6.1 Detection Capabilities. Instruments designed to continuously monitor radioactivity in gaseous effluent streams shall have a minimum level of detectability for the radionuclide in question. These values are given in Table 1 in ANSI N42.18.

3.5.2.6.2 Detection in Liquid Streams. Instruments designed to continuously monitor radioactivity in liquid streams shall have a minimum level of detectability for the radionuclides in question. These values are given in Table 1, under liquids.

3.5.2.6.3 Detection Range. The dynamic range of an instrument should be at least four orders of magnitude and should be stated in units of microcuries per millimeter. The range of the effluent monitoring instrumentation should overlap the emergency instrumentation.

3.5.2.6.4 Instrument Sensitivity. The sensitivity of an effluent monitoring instrument should be given for a particular radionuclide at the 95% confidence interval in the presence of a specific background count rate.

3.5.2.7 General Methods. The general methods consider airborne radioactive materials in particles and gases.

3.5.2.7.1 Air Filters for Particulate. Air filtration is the most frequently employed method in sampling atmospheres for radioactive particles. A filter efficiency of 100% is not required, but it is necessary to know the efficiency for the particle size and the flow rate selected or to know that the efficiency will be equal to or greater than some minimum acceptable efficiency. In general, an air filter that has a high efficiency is less likely to be affected by particle size.

Various types of filters are discussed in this ANSI standard, however ANSI N13.1 should be referred to for more details on filters and related equipment such as vacuum pumps.

3.5.2.7.2 Flow Measuring Devices and Flow Control for Particulate. The flow rate must be measured to determine the airborne radioactive material concentration and to ensure that the collector is being operated at its design flow rate. Flow measuring instruments should be, in every possible case, located on the downstream side of the collector. Provision must be made for adjusting the sampling rate to the required value and be recorded if necessary to record the total volume.

3.5.2.7.3 Gases. Airborne, radioactive, volatile materials, and so-called permanent gases such as tritium are frequently contaminants and their sampling and collection requires techniques and methods differing from those used in particle sampling.

3.5.2.7.4 General Gas Sampling. In general, some gas sampling is performed with the purpose of collecting the various constituents of the gas in or on various types of collector media. When the separation and removal of a constituent is required, continuous rather than grab samples are taken. Sampling rates must be established to ensure adequate sensitivity for the radioassay method selected and must be compatible with the collector's performance characteristics.

3.5.2.7.5 Solid Absorbents. Beds of granular solids may be employed as collectors. The absorbent should be specific and efficient for the radioactive gas or vapor. The method of measuring the absorbed radioactive gas or vapor must be capable of evaluating all the absorbed species. The nonradioactive materials present must not interfere with or destroy the efficiency of the absorbent.

Water, vapor, dust, organic compounds, and acids may exhaust the capacity or poison the beds. These constituents must be removed from the stream or the sampling must be adjusted to minimize the effects of such a contaminant.

3.5.2.7.6 Charcoal. Activated charcoal which is generally used as a capsule or granular bed is an efficient absorber of halogens, notably radioiodine. High humidity may impair the effectiveness of the charcoal.

3.5.2.7.7 Gas Washing. Specific chemical reactions or preferential solubility in liquids may be employed to remove certain radioactive gases and vapors from an airstream sample. For the removal to take place efficiently the air must be dispersed as fine bubbles by a porous distribution disc or perforated entry port. Efficiencies of greater than 99% for molecular iodine in caustic should be easily achieved.

3.5.2.7.8 Sampling and Collection Without Separation of Specific Constituents. In some instances, a sample of air and all the contained radioactive constituents may be desired for measurement of trends or relative levels of airborne materials. Flow through air sample chambers may be monitored by gamma ray scintillation crystals or other detectors held adjacent to the chamber. Prior filtering of the vessel will limit the vessel to true gases and filter out the particulate material.

3.5.2.7.9 Validation of Sampling Effectiveness. Air sampling based on the skilled application of the principles and methods presented in ANSI 42.18 should provide the information required to correctly assess and control the airborne radiological hazard in the plant. In a corresponding manner, the results from sampling a stack or other exhaust from a facility should be consistent with the results obtained from air samples drawn downwind or in the vicinity of the facility.

Although the interpretation of atmospheric samples is subject to large uncertainties due to meteorological variables, it is possible to reinforce the validity of the effluent sampling by showing that the environmental concentrations are consistent with the effluent sampling results.

3.5.2.7.10 Appendices. The appendices contain specific guidance for the implementation of the standard with respect to the following:

- Appendix A Guide for Sampling from Ducts and Stacks
- Appendix B Particle Deposition in the Sample Lines
- Appendix C Errors due to Anisokinetic Sampling.

In summary, the complete ANSI 42.18 standard should be consulted for details. The portion of the standard presented in this FEMP is only a summary of the thorough guidance offered in the standard itself. Table 3-2 gives a summary of the applicable regulations and standards.

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Table 3-2. Applicable Regulations and Standards.

Agency/Originator	Regulation No.	HA	HL	RA	RL	Summary/Application
U.S. Department of Energy, (DOE) Washington, D.C.	DOE Order 5400.1, 1988 General Environmental Protection Program	X	X	X	X	Outlines effluent monitoring requirements
	DOE Order 5400.5, 1990 Radiation Protection of the Public and Environment			X	X	Protects public/environment from radiation associated with DOE operations
	DOE Order 5480.4, 1989 Environmental Protection, Safety, and Health Protection Standards	X	X	X	X	Sets requirements for the application of the mandatory environmental protection, safety, and health (ES&H) standards; lists reference ES&H standards
	DOE Order 5484.1, 1981 Environmental Protection, Safety, and Health Protection Information Reporting Requirements	X	X	X	X	Sets requirements for reporting information having environmental protection, safety and health protection significance
	DOE Order 5820.2A, 1988 Radioactive Waste Management	X	X	X	X	Sets radioactive waste management requirements
U.S. Environmental Protection Agency, (EPA) Washington, D.C.	40 CFR 61, 1989 National Emission Standards for Hazardous Air Pollutants	X		X		Sets national emission standards for hazardous air pollutants (NESHAP)
	40 CFR 61, 1989 Subpart A General Provisions	X				Regulates hazardous pollutants
	40 CFR 61, 1989 Subpart H National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities			X		Sets emissions standards/monitoring requirements for radionuclides
	40 CFR 122, 1983 EPA Administered Permit Programs: The National Pollutant Discharge Elimination System		X			Governs release of nonradioactive liquids
	40 CFR 141.16, 1989 Safe Drinking Water Act (National Interim Primary Drinking Water Regulations)		X		X	Sets maximum contaminant levels in public water systems
	40 CFR 191, 1985 Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes				X	Regulates radioactive waste disposal
	40 CFR 261, 1989 Identification and Listing of Hazardous Waste		X			Identifies and lists hazardous wastes
	40 CFR 302.4, 1980 Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA): Designation, Reportable Quantities and Notification	X	X	X	X	Designates hazardous materials, reportable quantities, notification process

Table 3-2. Applicable Regulations and Standards.

Agency/Originator	Regulation No.	HA	HL	RA	RL	Summary/Application
EPA (Cont'd)	40 CFR 355, 1987 Superfund Amendments and Reauthorization Act of 1986 (SARA): Emergency Planning and Notification	X	X			Identifies threshold planning quantities for extremely hazardous substances
American National Standards Institute, (ANSI) New York, New York	N 13.1 - 1969* Guidance to Sampling Airborne Radioactive Materials in Nuclear Facilities			X		Sets standards for effluent monitoring systems
	N 42.18*, 1974 Specification and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents			X	X	Recommendations for the selection of instrumentation for the monitoring of radioactive effluents
Washington State Department of Ecology, (Ecology) Olympia, Washington	WAC 173-216, 1989 State Waste Discharge Permit Program		X			Governs discharges to ground and surface waters
	WAC 173-220, 1988 National Pollutant Discharge Elimination system Permit		X		X	Governs wastewater discharges to navigable waterways; controls NPDES permit process
	WAC 173-240, 1990 Submission of Plans and Reports for Construction of Wastewater Facilities		X			Controls release of nonradioactive liquids
	WAC 173-303, 1989 Dangerous Waste Regulations		X			Regulates dangerous wastes; prohibits direct release to soil columns
	WAC 173-400, 1976 General Regulations for Air Pollution Sources	X				Sets emissions standards for hazardous air pollutants
Benton-Franklin Walla-Walla Counties Air Pollution Control Authority, (APCA) Richland, Washington	General Regulation 80-7, 1980	X				Regulates air quality

HA = hazardous airborne.
HL = hazardous liquid.
RA = radioactive airborne.
RL = radioactive liquid.
*Refers to standards that are referenced in the DOE and EPA regulations.

4.0 IDENTIFICATION AND CHARACTERIZATION OF EFFLUENT STREAMS

Radionuclides are emitted from KE/KW at four locations for air emissions and one liquid effluent discharge. Radionuclides are discharged to the air from the 105-KE Fuel Storage Basin, the 105-KW Fuel Storage Basin, the 1706-KEL Environmental and Engineering Demonstration Laboratory and the 1706-KER Water Studies Recirculation Building. Radionuclides are discharged to the Columbia River from one discharge point located at the 1908-KE Outfall, also known as NPDES Outfall 004 (EPA 1981). The radionuclides emitted from the effluent release points via the air pathway and via the liquid effluent pathway are: ^{3}H, ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, and ^{240}Pu.

4.1 IDENTIFICATION AND CHARACTERIZATION OF SOURCE TERMS CONTRIBUTING TO EACH EFFLUENT STREAM

This section documents the amount, activity, or concentration of the hazardous and radioactive materials in the 100-K Facilities effluent streams at the point of discharge that are available to expose personnel either within the facility or beyond the site boundary from normal and upset conditions.

The source of the KE/KW radioactive effluents is the N Reactor fuel stored in the basins since 1975. The K Area FEMP determination document (WHC 1991b) reviewed effluent data from 1981 to 1989 to determine if the data from any one of these years was representative of the 9 yr period. It was determined that the 1989 effluents were representative of the discharges during the 1980's, as shown in Table 4-1. No irradiated fuel has been added to the basin since 1989. Futhermore, there is little future potential for adding newly irradiated fuel containing short lived isotopes to the basins at KE and KW. Therefore, it was decided to use the 1989 effluent release data to determine the type of effluent monitoring at each release point.

4.1.1 Source Terms Contributing to Airborne and Liquid Effluent Stream from 105-KE and KW

The 100-K Area accountability records indicate that the KE and KW Fuel Storage Basins contain 1150 t of irradiated fuel in the KE Basin and 956 t of irradiated fuel in the KW Basin. As discussed in Section 2.3, it was calculated that the KE Basin contains approximately 8.5 MCi and the KW Basin contains approximately 3.9 MCi.

Because some of the fuel at KE is stored in open top canisters and approximately 7 to 10% of the fuel cladding has failed, the water in the basin contains approximately 56 Ci of radioisotopes that have migrated from the fuel to the water. In contrast, the KW Basin which has water tight containers has approximately 2.9 Ci of radioactivity that have migrated from the fuel to the water in the basin.

Table 4-1. K Area Airborne Emissions and Liquid Effluents 1981-1989. (Ci)

Airborne Releases									
	1981	1982	1983	1984	1985	1986	1987	1988	1989
105-KE	6.26 E-03	1.22 E-03	1.72 E-03	2.29 E-03	1.31E-03	2.85 E-04	7.44 E-04	1.64 E-04	1.25 E-04
105-KW	NA[a]	NA	7.39 E-05	4.18 E-04	1.18E-04	9.64 E-05	6.71 E-05	9.23 E-05	5.74 E-05
1706-KEL	5.54 E-06	6.40 E-06	3.64 E-06	1.38 E-07	5.96E-07	1.14 E-05	7.30 E-06	3.62 E-06	3.21 E-06
1706-KER	NA[a]	NA	NA	NA	NA	NA	NA	NA	1.71 E-06
TOTAL	6.26 E-03	1.22 E-03	1.8 E-03	2.71 E-03	1.43E-03	3.93 E-04	8.18 E-04	2.60 E-04	1.88 E-04
Liquid Releases									
	1981	1982	1983	1984	1985	1986	1987	1988	1989
1908-KE	7.79 E-02	7.54 E-02	7.72 E-02	3.44 E-02	3.48 E-02	2.43 E-02	4.36 E-02	2.95 E-02	3.4 E-01

Source: Fogel (1982), Green (1990), Rokkan (1984, 1985, 1986, 1987, 1989, 1990b, 1991)

[a]Release quantities not available

4.1.2 Source Terms Contributing to Airborne Effluent Stream from KEL and KER

While at present there are no radioactive or hazardous materials being used in KEL and KER, these materials were used when there was ongoing research at the facility. Currently, there is no work planned to take place in 1706-KEL or KER that involves radioactivity or hazardous materials. There are, however, small quantities of radionuclides being stored and low levels of contamination.

4.2 100-K AREA NORMAL OPERATIONS EFFLUENT RELEASE DATA

4.2.1 100-K Area Normal Operations Airborne Effluent Release Data

Radioactivity is released from the roof vents over the KE and KW fuel storage basins without the use of environmental control equipment. The isotopes released are: ^{60}Co, ^{90}Sr, ^{134}Cs, ^{137}Cs, ^{238}Pu, ^{239}Pu, and ^{240}Pu.

In 1989 the facilities airborne releases ranged from a high of 4.4×10^{05} Ci of ^{137}Cs at 105-KE to a low of 5.5×10^{-10} Ci of ^{238}Pu at 1706-KER. The total airborne release in 1989 was 1.9×10^{-04} Ci. Details of the releases from the specific release points in 1989 are shown in Table 4-2.

4.2.2 KE/KW Normal Operations Liquid Effluent Release Data

The K Area operations liquid releases of radioactivity occur at a single release point, known as 1908-KE Outfall or NPDES Outfall 004 (EPA 1981). The isotopes released to the Columbia River via this release point are: ^{3}H, ^{60}Co, ^{90}Sr, ^{137}Cs, $^{239,240}Pu$.

In 1989 the release of radioactivity from this outfall ranged from 2.6×10^{-01} Ci of ^{3}H to 9.2×10^{-06} Ci of $^{239,240}Pu$. The total liquid release in 1989 was 3.4×10^{-01} Ci. The details of the release are shown in Table 4-3.

4.3 KE/KW UNPLANNED-POTENTIAL EFFLUENT CALCULATIONS

The unplanned-upset potential effluent data was developed using two assumptions. For airborne releases, the unplanned-upset condition was a conservative, hypothetical release of 1.0×10^{-06} of the fission products inventory from the 10% failed fuel, to the basin water and subsequently, 1.0×10^{-03} the basin water fission products inventory to the atmosphere for an overall partition coefficient of 1.0×10^{-10}.

The potential upset airborne emission as shown in Table 4-4 shows the potential or hypothetical airborne emission to be 8.5×10^{-04} Ci from 105-KE and 3.8×10^{-04} Ci from 105-KW.

For liquid releases, the unplanned upset condition is a conservative, hypothetical release of one percent of the radioactive basin water

Table 4-2. Normal Operation Radioactive Airborne Emissions from K Area. (1989 Emissions)

	Release Point	Release Quantity (Ci)
105-KE	^{60}Co	3.70 E-05
	^{90}Sr	1.90 E-05
	^{134}Cs	2.50 E-05
	^{137}Cs	4.40 E-05
	^{238}Pu	5.70 E-08
	$^{239,240}Pu$	3.20 E-07
Subtotal		1.26 E-04
1706-KEL	^{60}Co	3.20 E-06
	^{238}Pu	2.40 E-09
	$^{239,240}Pu$	3.00 E-09
Subtotal		3.20 E-06
1706-KER	^{60}Co	1.00 E-06
	^{90}Sr	2.10 E-08
	^{137}Cs	6.90 E-07
	^{238}Pu	5.50 E-10
	$^{239,240}Pu$	1.80 E-09
Subtotal		1.71 E-06
105-KW	^{60}Co	3.30 E-05
	^{90}Sr	4.10 E-07
	^{137}Cs	2.40 E-05
	^{238}Pu	6.00 E-09
	$^{239,240}Pu$	1.10 E-08
Subtotal		5.74 E-05

Source: Rokkan (1991)

Table 4-3. Normal Operation Radioactive Liquid Effluents from K Area. (1989 Emissions)

	Release Point	Release Quantity (Ci)
1908-KE	^{3}H	2.6 E-01
	^{60}Co	6.6 E-02
	^{90}Sr	1.0 E-03
	^{137}Cs	1.0 E-02
	$^{239,240}Pu$	9.2 E-06
Subtotal		3.37 E-01

Source: Rokkan (1991)

directly to the Columbia River. This is assuming the basin level overflows the basin water level and the plugs fail to function. Using this pathway radionuclides are assumed to be released directly to the Columbia River. These releases were treated as being emitted over an entire year. The assumption that an upset condition lasts an entire year is a further conservative assumption required by the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991) to evaluate the need for continuous effluent monitoring.

Table 4-5 shows the hypothetical potential liquid effluent release is 5.9×10^{-01} Ci from the 1908-KE Outfall to the Columbia River from the KE and KW fuel storage basins.

Table 4-4. Normal Operation Airborne Emissions for K Area Unplanned-Upset Conditions.

Release Point	Release Quantity (Ci)
105-KE	8.5 E-04
105-KW	3.8 E-04

NOTE: (8.5 x 10^{06}Ci in KE Basin) x (1.0 x 10^{-04} Radionuclides to Water) x 1.0 x 10^{-06} Radionuclides to Air) = 0.00085 Ci (8.5 x 10^{-04} Ci)

Table 4-5. Normal Operation Liquid Effluent Release for K Area Unplanned-Upset Condition.

Release Point	Release Quantity (Ci)
1908-KE	5.9 E-01

NOTE: 1% of the Ci in KE and KW Basin water are assumed to be released to the Columbia River.

5.0 EFFLUENT POINT OF DISCHARGE DESCRIPTION

Of the six effluent discharge points in the 100-K Area, only five effluent discharge points have the potential for containing radiological and/or hazardous pollutants. These include one liquid release point and four air release points. The following descriptions of each release point include the precise location and identification of all contributing streams (actual and potential), physical description of the system, precise location of the sampling/monitoring points, instrumentation, flow rates, and the range of environmental conditions to which the instrumentation is exposed.

5.1 AIRBORNE DISCHARGE POINTS

As noted in Section 2-1, the 100-K Area is comprised of 49 buildings which house various facilities. Four of these buildings contain systems or material that could be contaminated and contribute radioactivity to the airborne effluent streams. These air release points in 105-KE, 105-KW, 1706-KEL, and 1706-KER consist of exhaust vents and are described below.

5.1.1 105-KW Exhaust Vent

The 105-KE and 105-KW buildings are identical in both design and vent characteristics. Two exhaust vents are located on the roof of the building above the fuel storage basin and another two vents are located above the transfer area, approximately 22 ft and 38 ft above the ground, respectively. The vents above the basin and transfer area exhaust at rates of 10,000 ft^3/min and 7,500 ft^3/min, respectively. The exhausts vent air directly to the atmosphere without treatment. The vents from above the basin are shown in Figure 5-1. These vents are typical of all the basin and transfer area exhausts from both 105-KW and 105-KE. Figure 5-2 shows a typical intake structure of an exhauster from the basin and transfer area. The exhausts are continuously sampled for radionuclides.

The sampling system for the exhaust, shown in Figure 5-3, consists of a 5/8-in.-dia stainless steel pipe that draws from both of the exhaust intakes and is pumped above the basin by a 1.2 ft^3/min pump to the sampling station. Samples are collected on a 47-mm glass fiber filter. A description of the sampling system is shown in Figure 5-4.

5.1.2 105-KE Exhaust Vent

The exhaust vents for the area which contains the fuel storage basin in the 105-KE building are located on the roof of the building directly above the fuel storage basin and transfer area, approximately 15 ft and 38 ft above the ground, respectively. The air directly over the basin is vented (without treatment) directly to the atmosphere by two exhausters at a rate of approximately 10,000 ft^3/min each.

Figure 5-1. K Basin Exhauster.

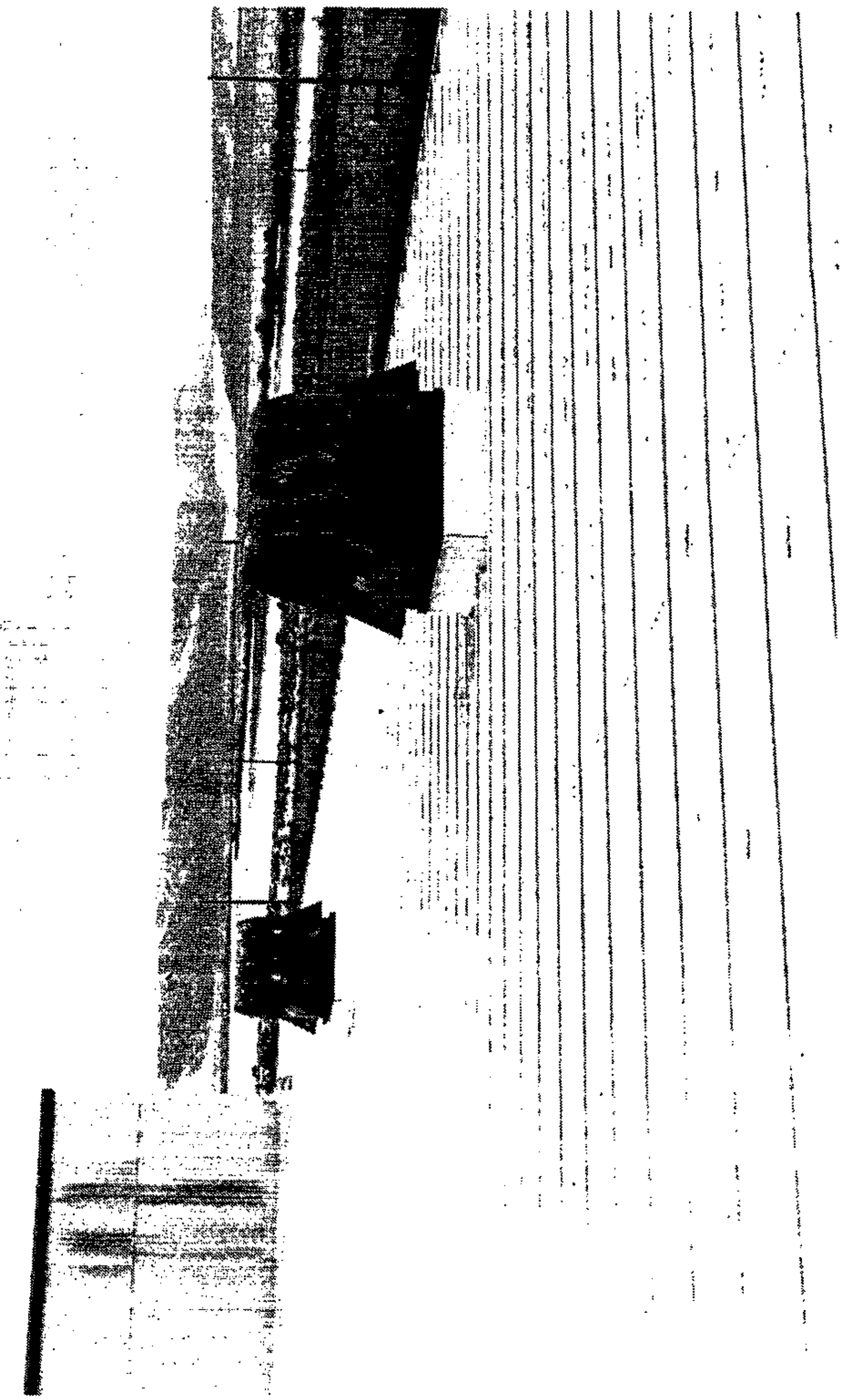


Figure 5-2. Typical K Basin Exhauster.

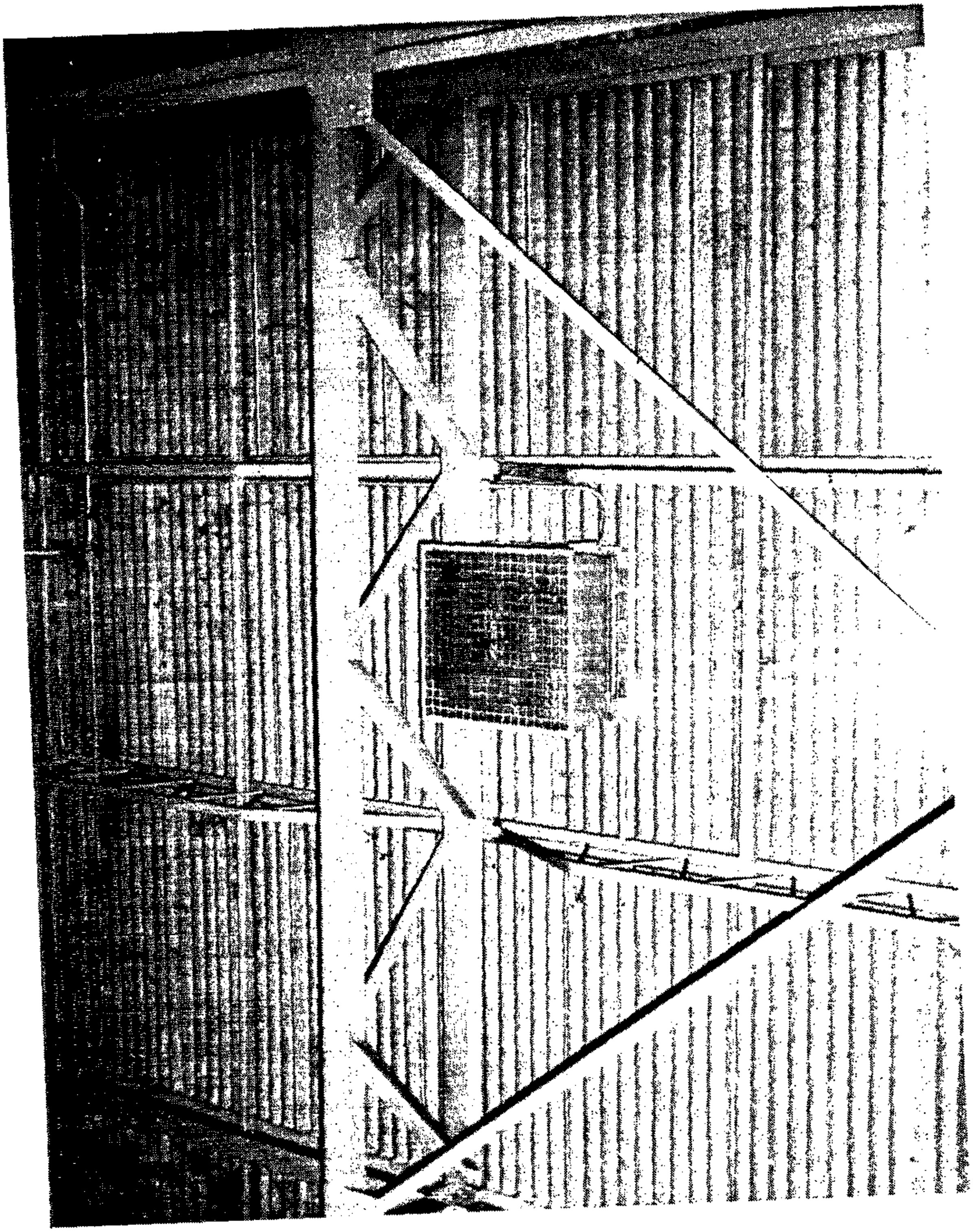


Figure 5-3. K Basin Sampler.

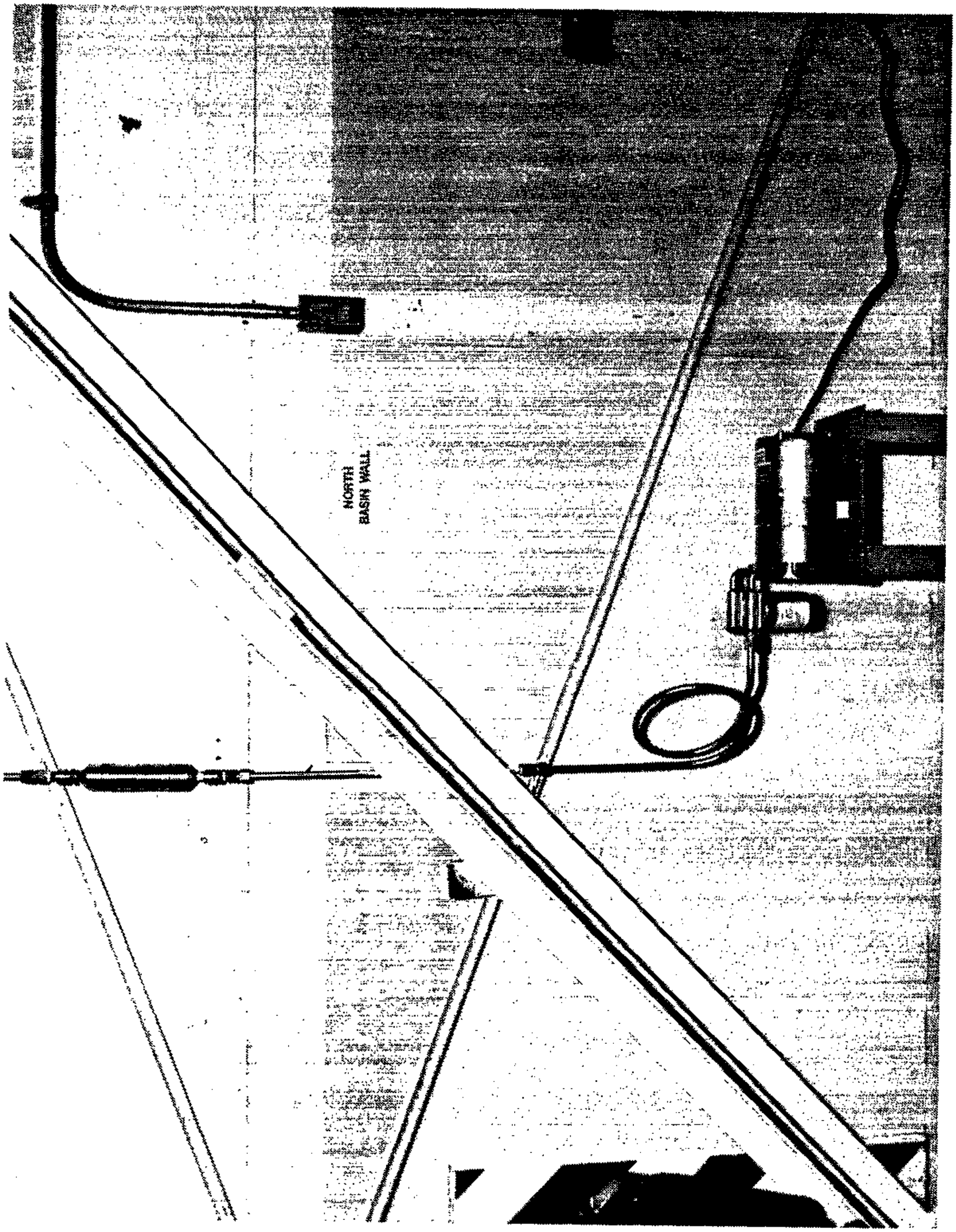
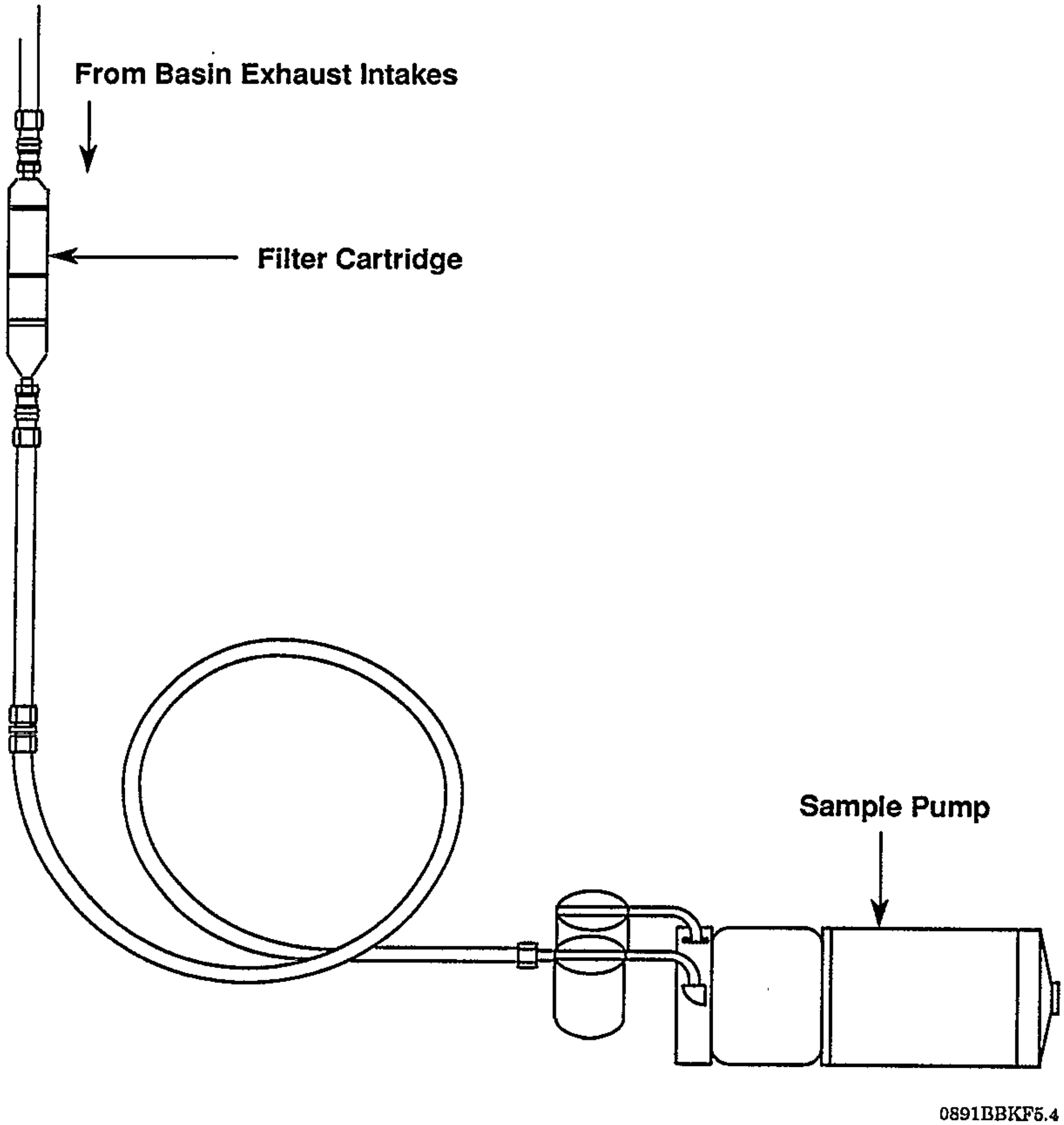


Figure 5-4. K Basin Sampler Schematic.



The air from the transfer area is vented directly to the atmosphere, without treatment, by two exhausters at a rate of approximately 7,500 ft^3/min each. As indicated, the exhaust configuration for 105-KE is identical to the configuration on 105-KW.

The sampling system for the exhaust consists of a 5/8-in.-dia stainless steel pipe that draws from the exhaust intakes and is pumped by a 1.2 ft^3/min pump to the sampling station. Samples are collected on a 47-mm glass fiber filter. Refer to Figures 5-1 through 5-4 for descriptions of the configurations.

5.1.3 1706-KEL Exhaust Vent

This exhaust, which is the vent for the 1706-KE Laboratory, releases air at a rate of 12,000 ft^3/min. The air from this vent is first passed through a High Efficiency Particulate Air (HEPA) filter before being released to the atmosphere. The release point is located approximately 25 ft above the ground. Figure 5-5 is a photo of the exhaust. Figure 5-6 is a description of the exhaust. Figure 5-7 shows the exhaust sampling system, including the sampling cartridge and the flow meters for the exhaust and the sampling system. These items are indicated on the schematic for the sampling system in Figure 5-8.

5.1.4 1706-KER Exhaust Vent

This vent, as shown in Figure 5-9, is the exhaust for the basement area of the 1706-KE Laboratory. This vent is located at ground level with a stack exhausting approximately 12 ft above the ground and discharging at an approximate rate of 2,500 ft^3/min. The air from this exhaust is passed through a HEPA filter before being released to the atmosphere. Figure 5-10 is a schematic of the exhaust. Figure 5-11 shows the exhaust sampling system, including the sampling cartridge, rotameter for measuring sampling flow, and sample pump. These items are indicated on the schematic for the sampling system in Figure 5-12.

5.2 LIQUID DISCHARGE POINTS

There are two liquid effluent discharges from the 100-K Area. Both discharges are permitted NPDES discharges. They are permitted under NPDES Permit No. WA-000374-3 as Outfalls 003 and 004 (EPA 1981). A diagram of the sources for these discharges is shown in Figure 5-13. A more detailed description of the release points is included in the following sections.

Figure 5-5. 1706-KEL Exhaust.

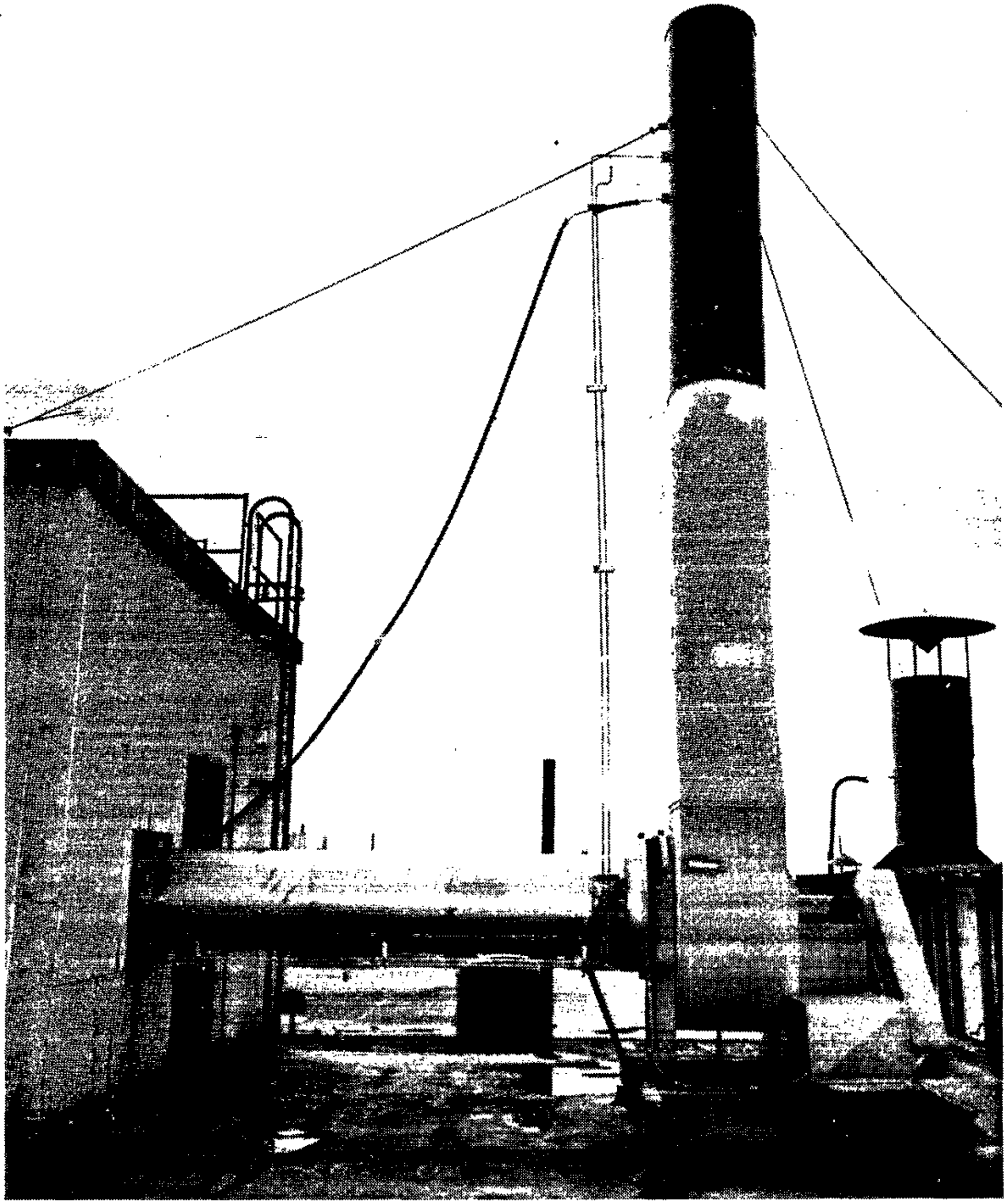


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Figure 5-6. 1706-KEL Exhaust Schematic.

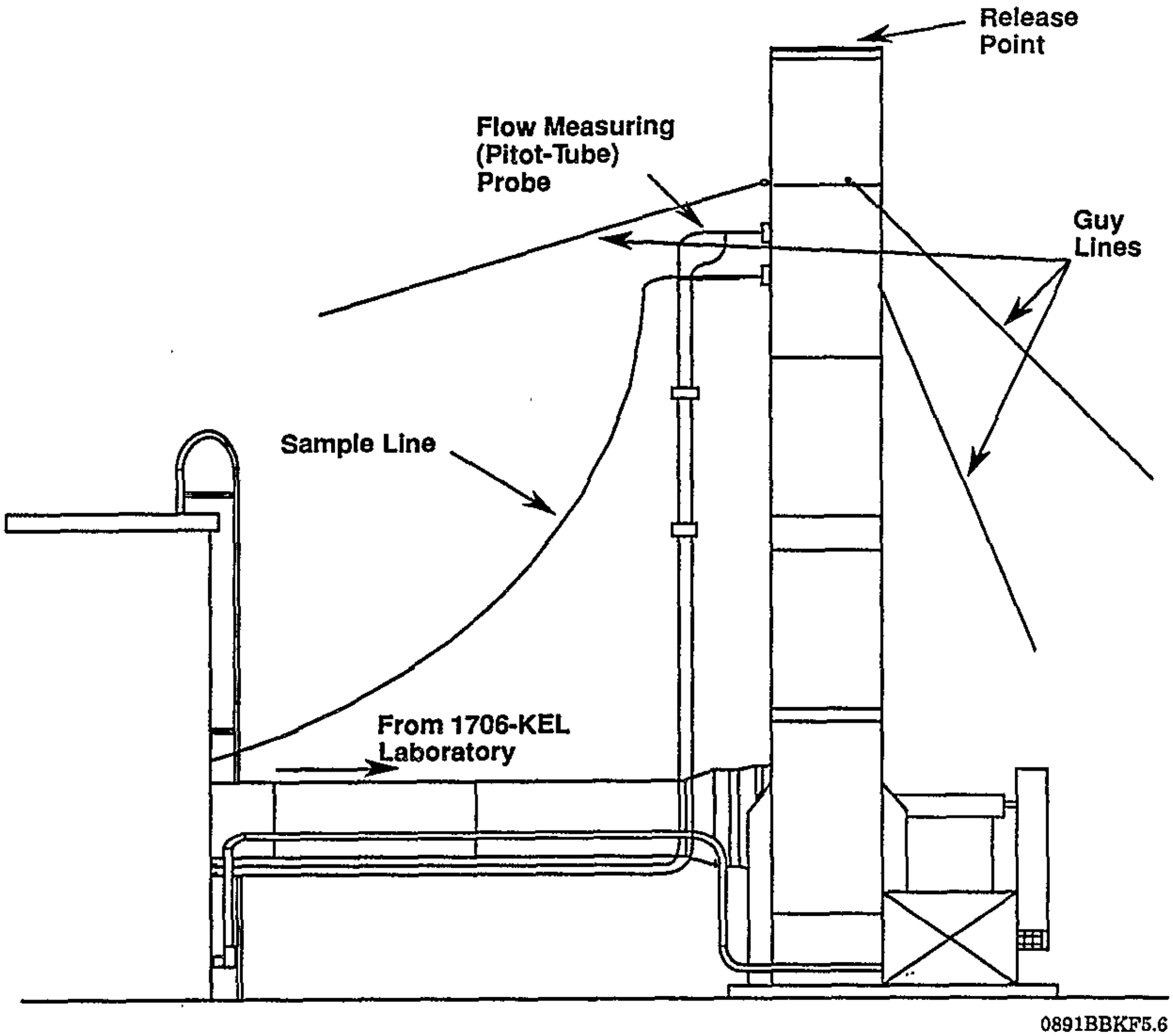

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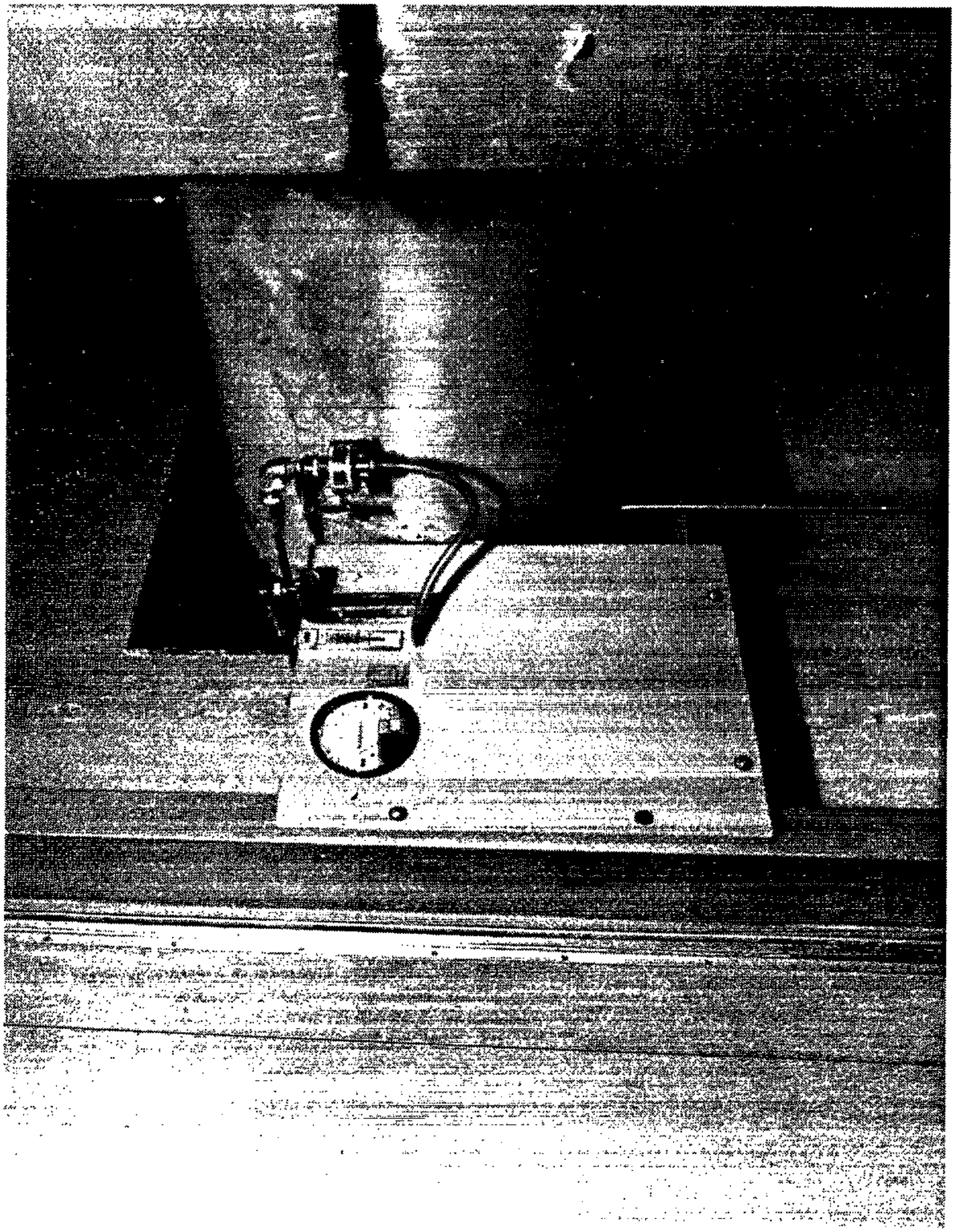
Figure 5-7. 1706-KEL Sampling System.



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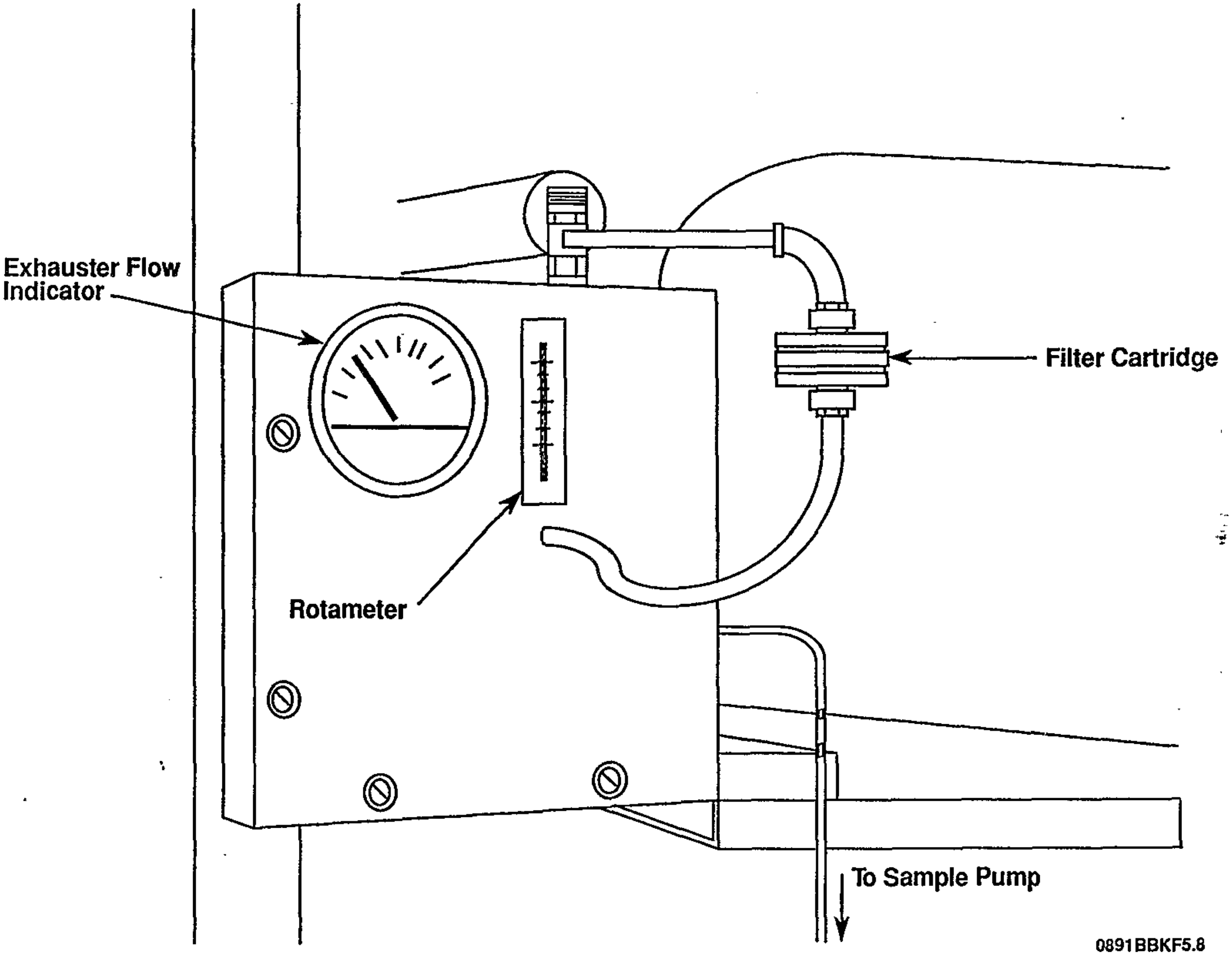
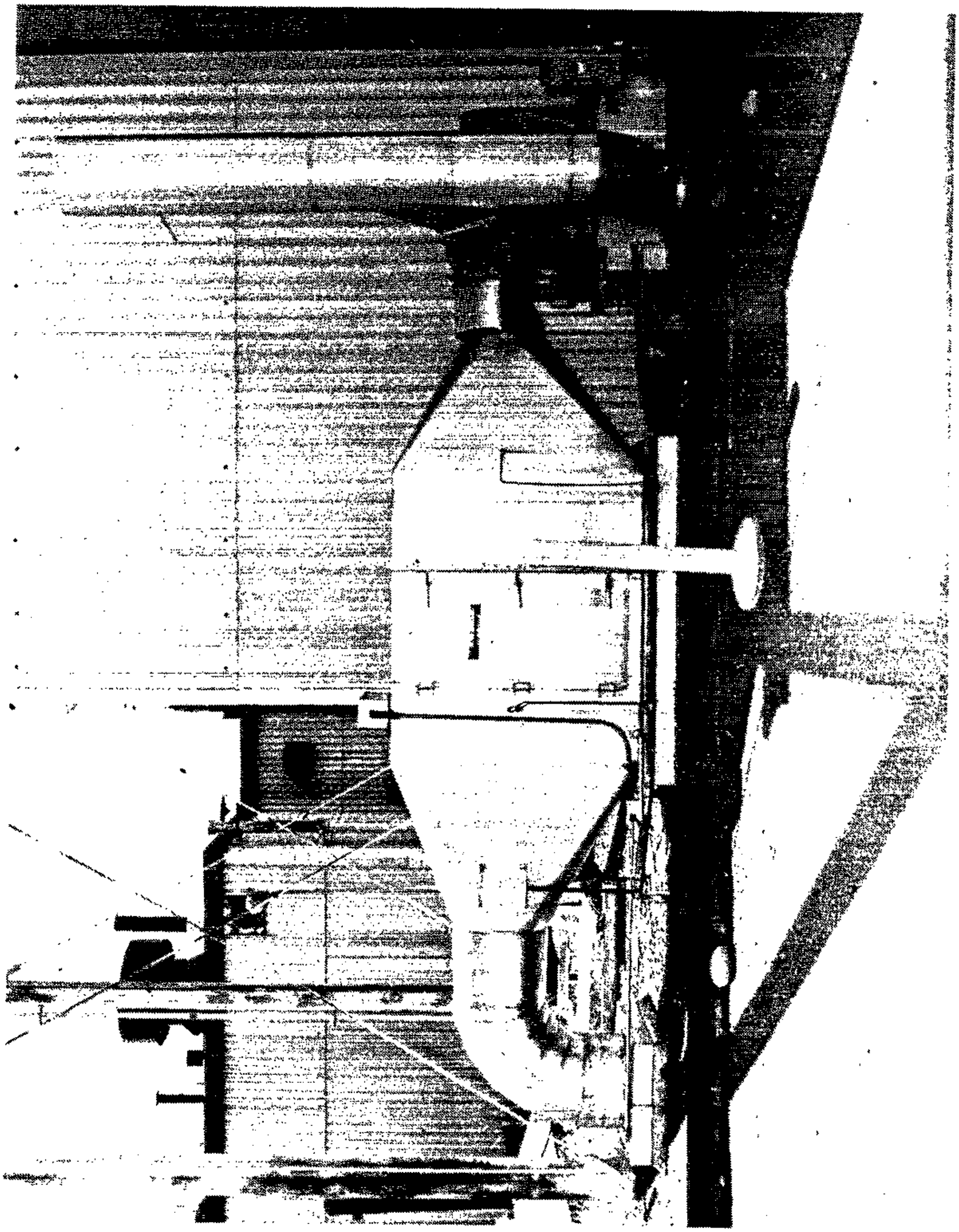


Figure 5-8. 1706-KEL Sampling System Schematic.

Figure 5-9. 1706-KER Exhaust System.



9212 2047

9 2 1 2 [illegible] 2 [illegible] 4 8

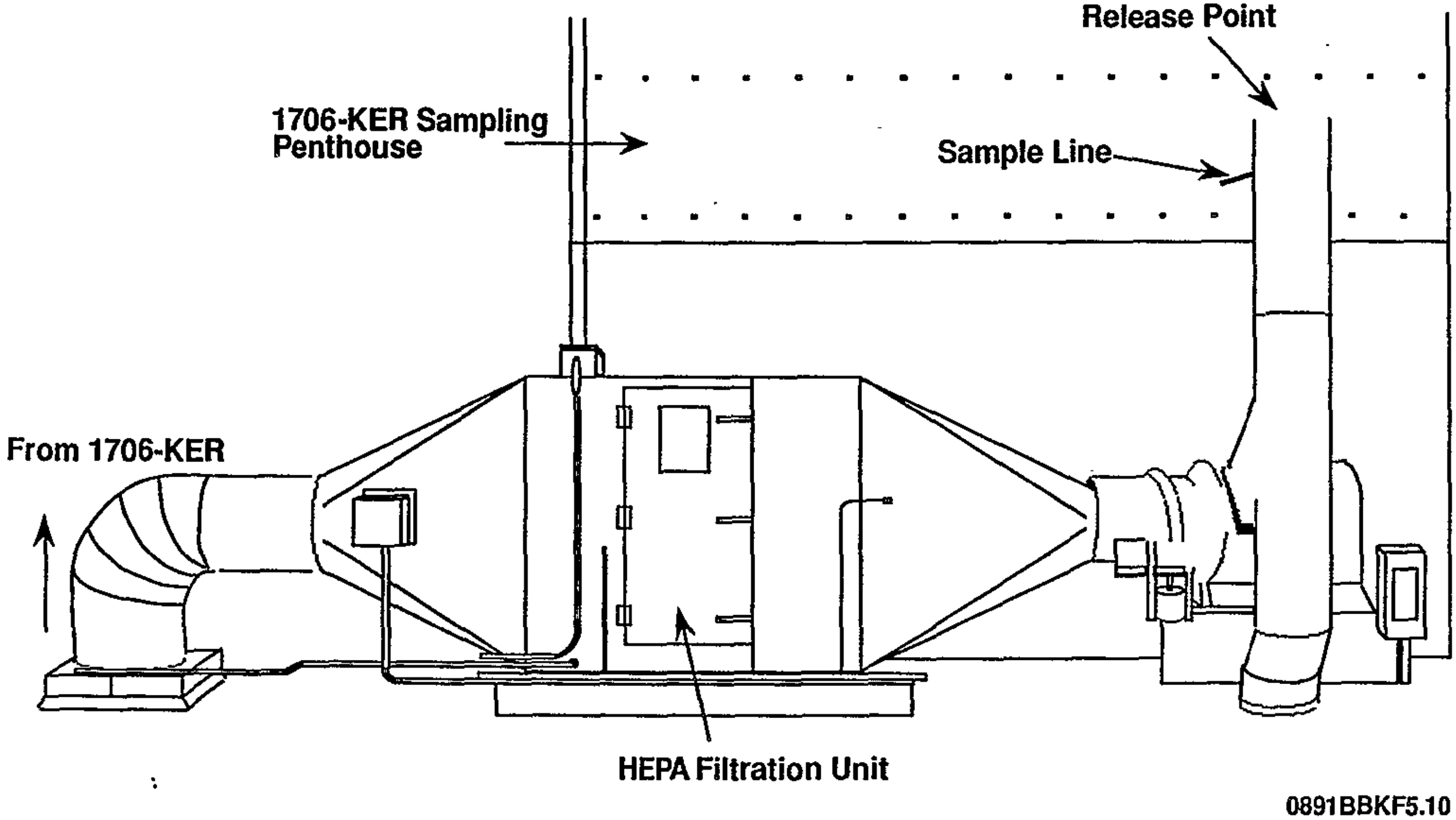


Figure 5-10. 1706-KER Exhaust System Schematic.

Figure 5-11. 1706-KER Sampling System.

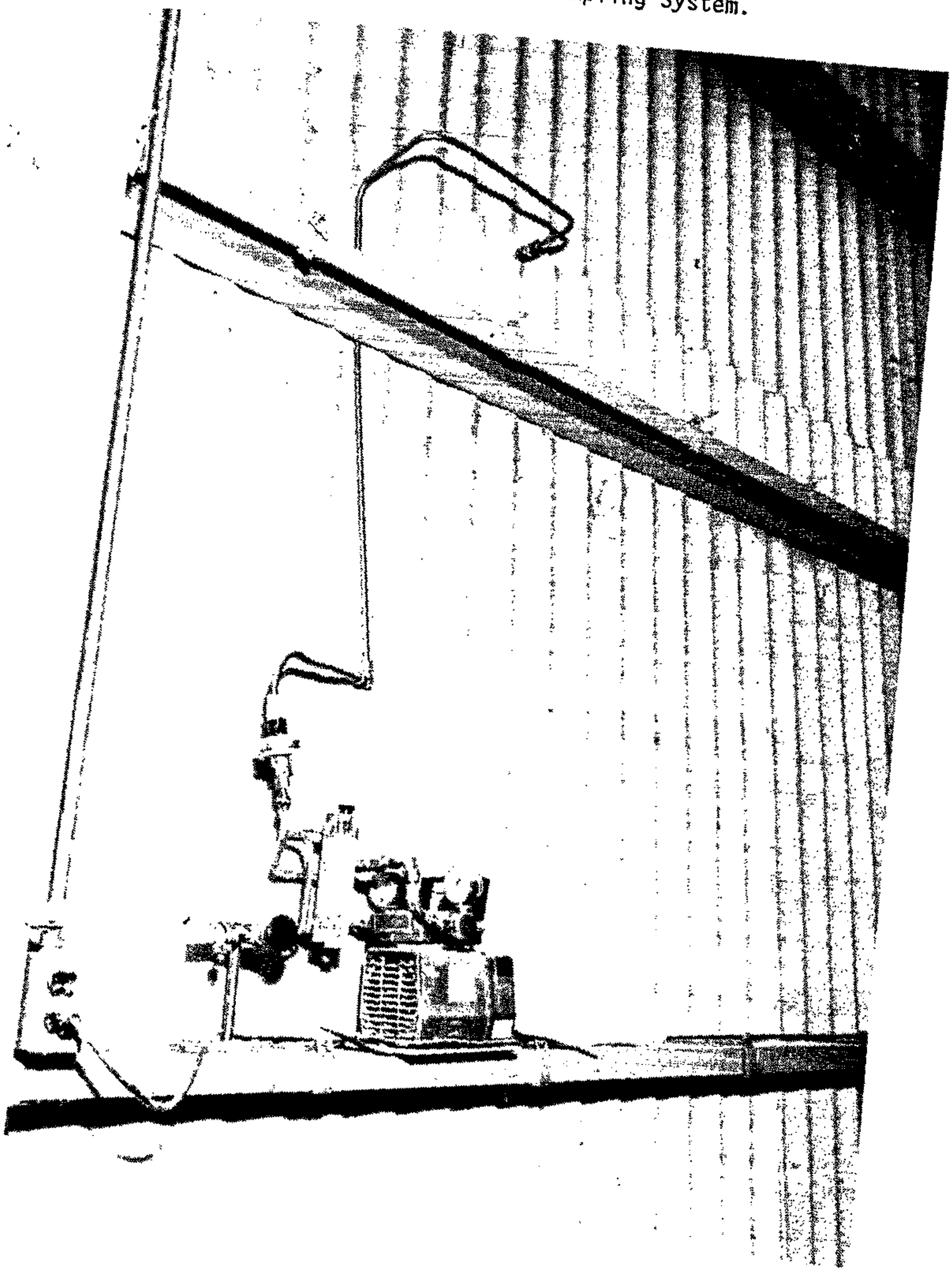
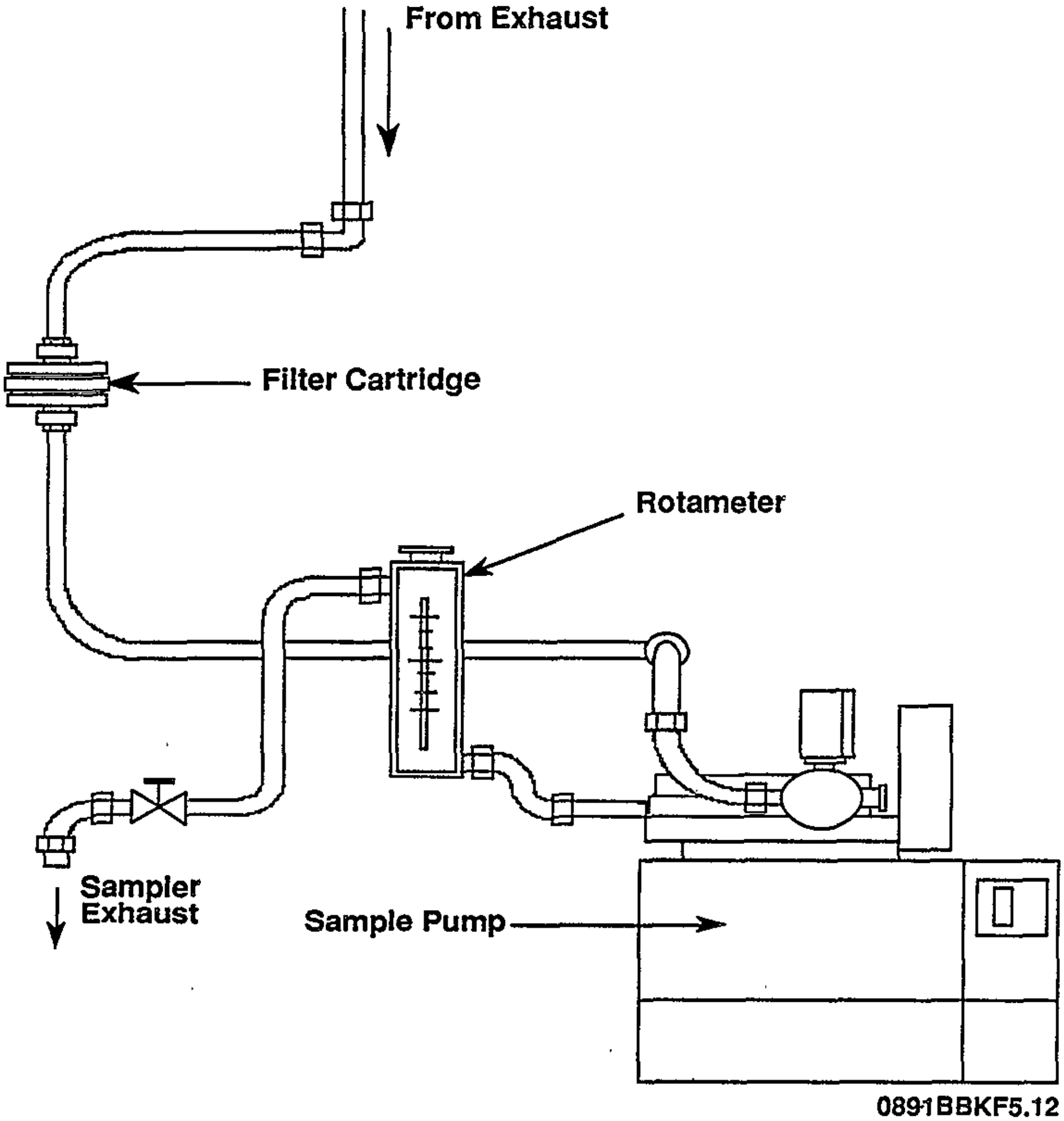


Figure 5-12. 1706-KER Sampling System Schematic.



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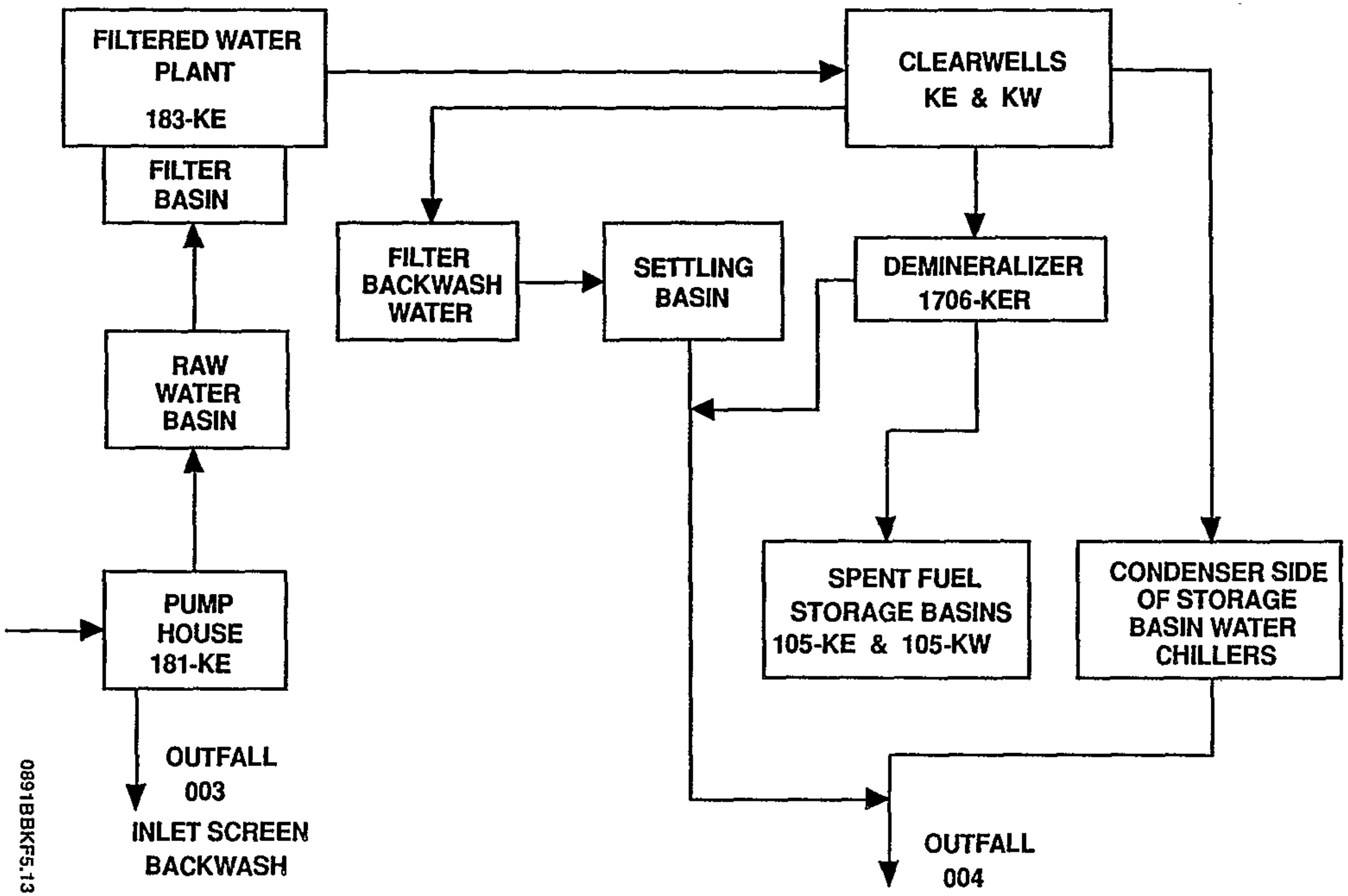


Figure 5-13. Water Usage at 100-K Area.

5.2.1 181-KE Outfall (NPDES Outfall 003)

Outfall 003, the discharge for the travelling filter screen and backwash water, is operated intermittently. This water contains only constituents removed from the river water being taken into the intakes of the 181-KE Building. The travelling filters remove debris from the river which is brought into the intakes of the 181-KE building. This outfall is a 12-in.-dia pipe which discharges at an average rate of 5,000 gal/day when operational. This pipe, as shown on the left side in Figure 5-14, comes from the 181-KE Pumphouse, enters the ground, and bends to the left before discharging beneath the surface of the Columbia River, approximately 575 ft towards the center of the river. When operational, this outfall is grab sampled to ensure NPDES permit compliance.

5.2.2 1908-KE Outfall (NPDES Outfall 004)

The primary liquid effluent discharge point at the K Area is the 1908-KE outfall. This discharge is permitted as NPDES Outfall 004. Cooling water used in the water chillers (which are used to maintain the fuel storage basin water temperature) is discharged through this outfall. The outfall also discharges the regeneration water from the 1706-KE Building ion exchange columns. This outfall discharges liquids to the Columbia River at a rate of approximately 3.7×10^{08} gal/yr.

The outfall is a pair of 84-in.-dia pipes that extend 1,350 ft from the 1908-KE Building (shown in Figure 5-15) and discharge beneath the surface of the Columbia River near the center of the channel. The outfall, as shown in Figure 5-16, is covered in rip-rap and continuously monitored for flow.

The samples for this outfall are drawn from the outfall pipe prior to the 1908-KE Building. The sample is drawn from the underground outfall pipe to the sample building through an insulated line, shown in Figure 5-17. There is a composite sampler on this outfall, shown in Figure 5-18, which collects a weekly sample for radionuclides. The composite sampler is shown in Figure 5-19. The outfall is equipped with a continuous flow recorder, shown in Figure 5-20. A description of the discharge and sampling system is shown in Figure 5-21.

Figure 5-14. Outfall 003.

Figure 5-15. 1908-KE Outfall Building.

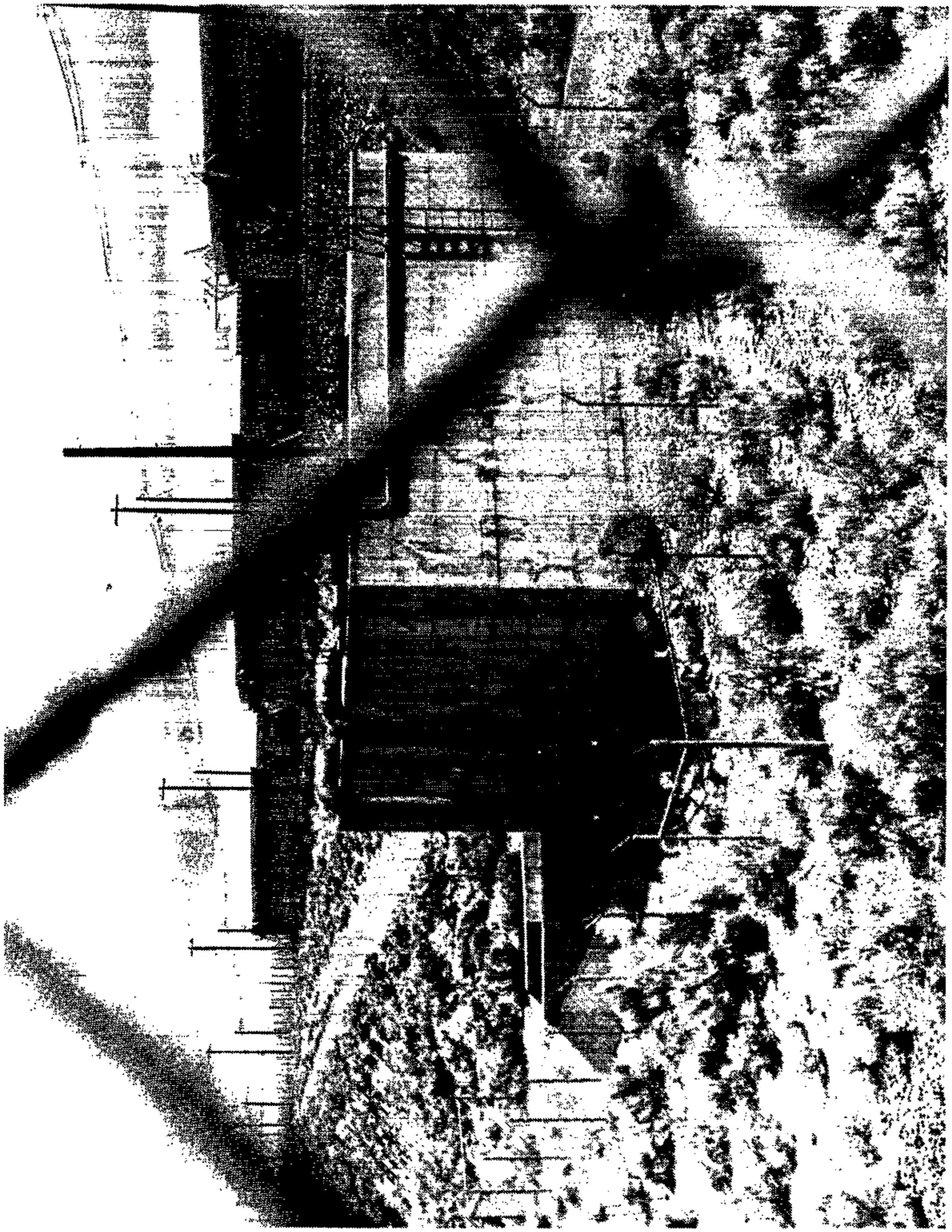


Figure 5-16. Outfall 004.

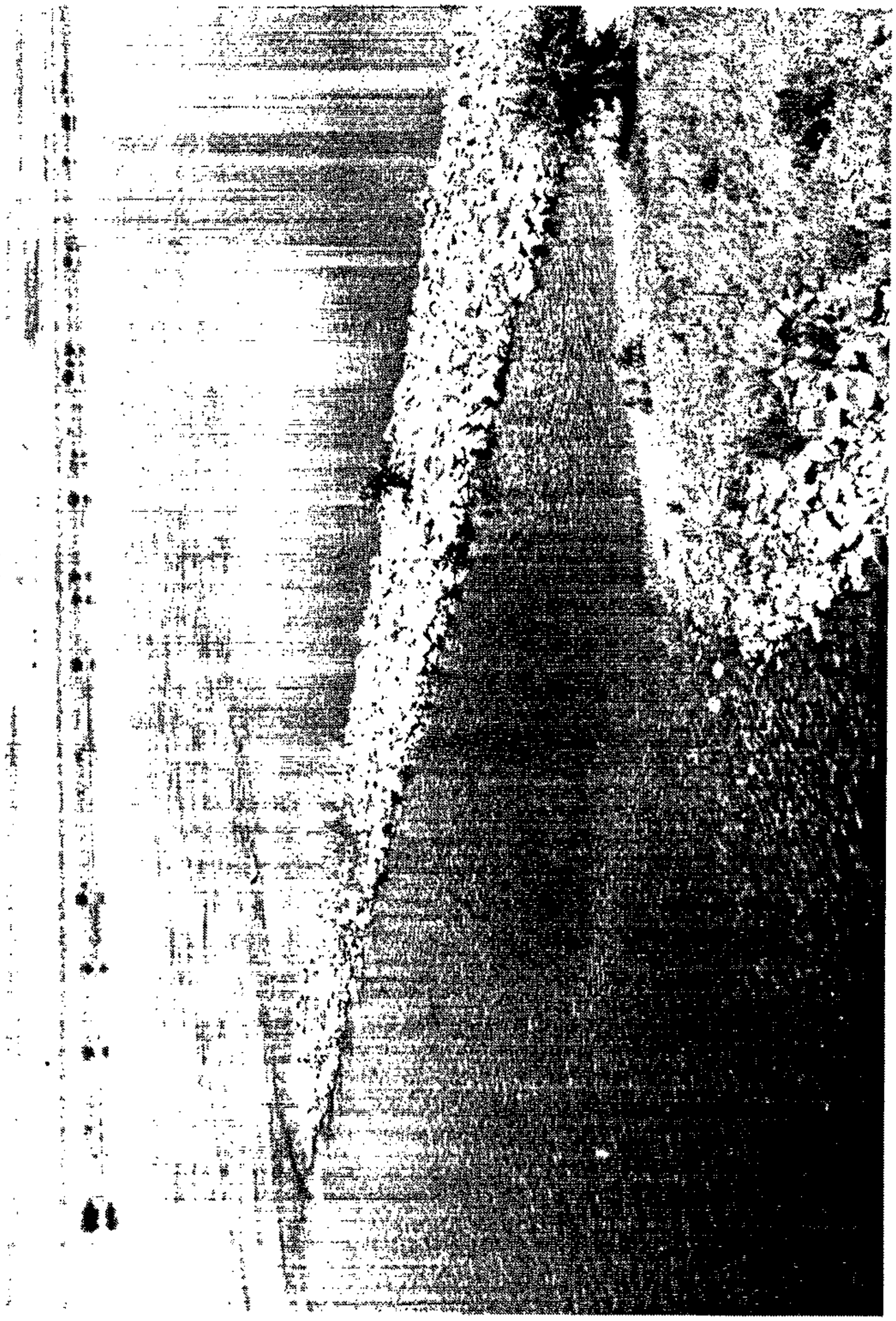


Figure 5-17. Outfall 004 Sampling Line.

Figure 5-18. Outfall 004 Composite Sampler.

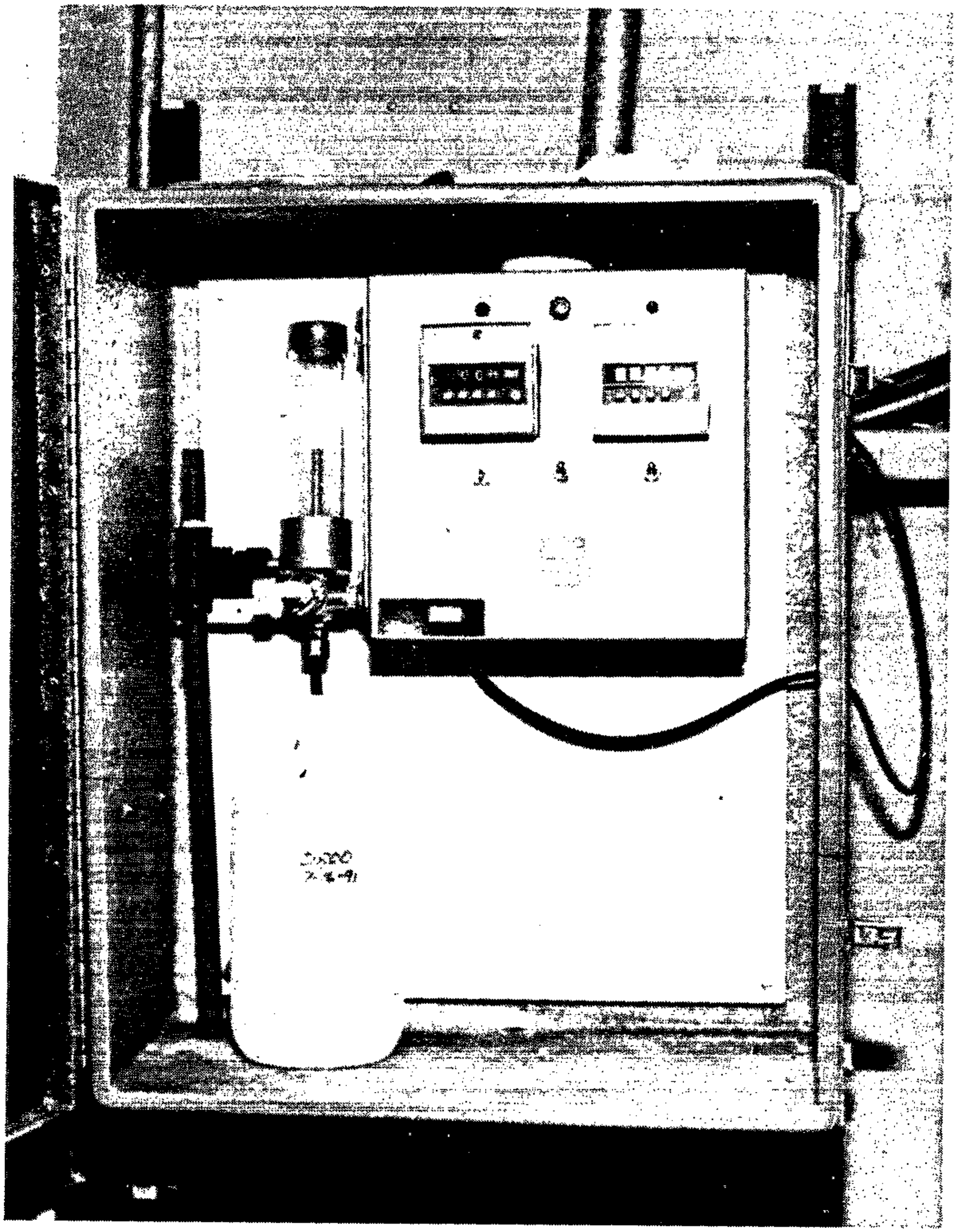


Figure 5-19. Outfall 004 Composite Sampler Schematic.

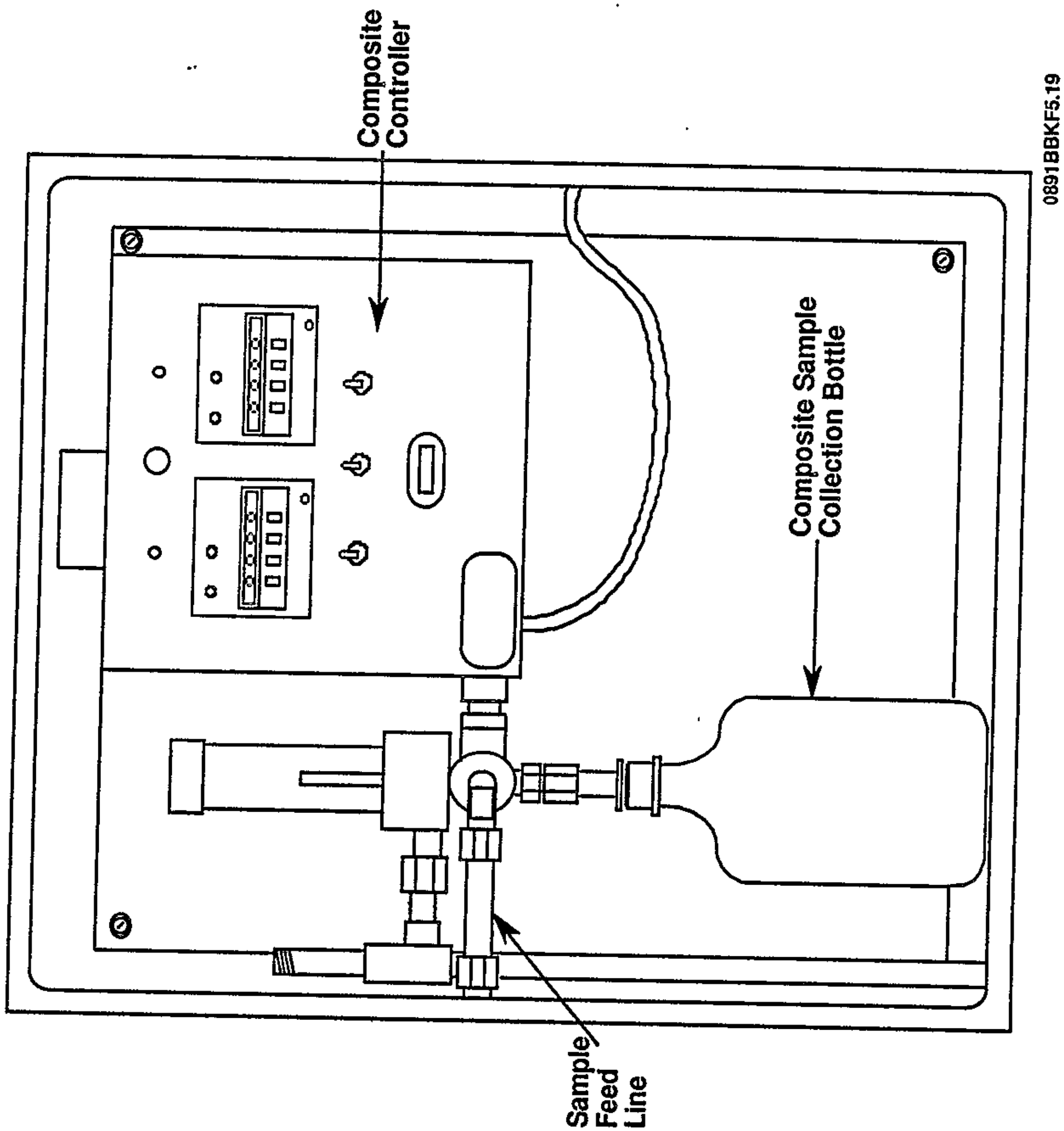


Figure 5-20. Outfall 004 Continuous Flow Recorder and Log Book.

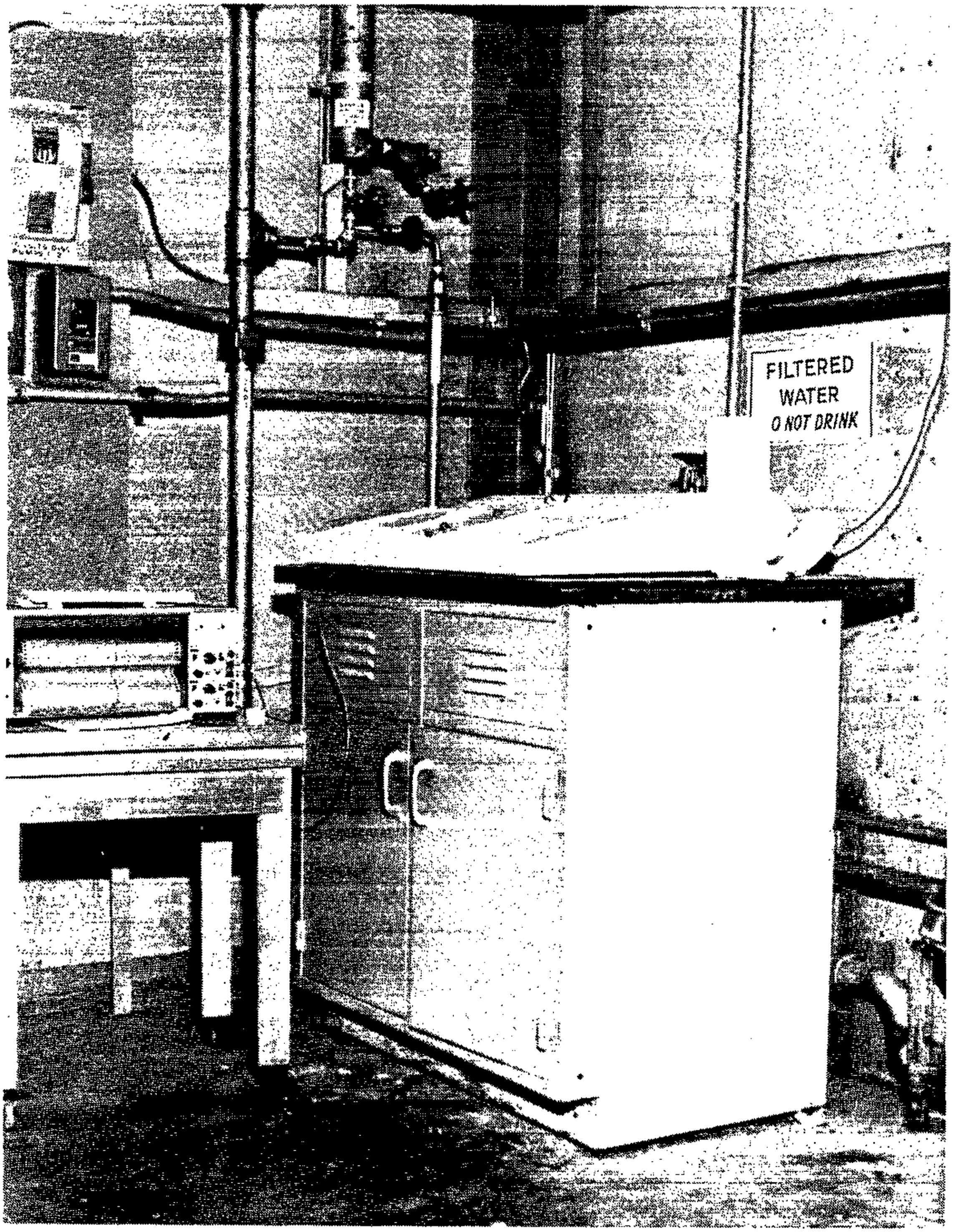
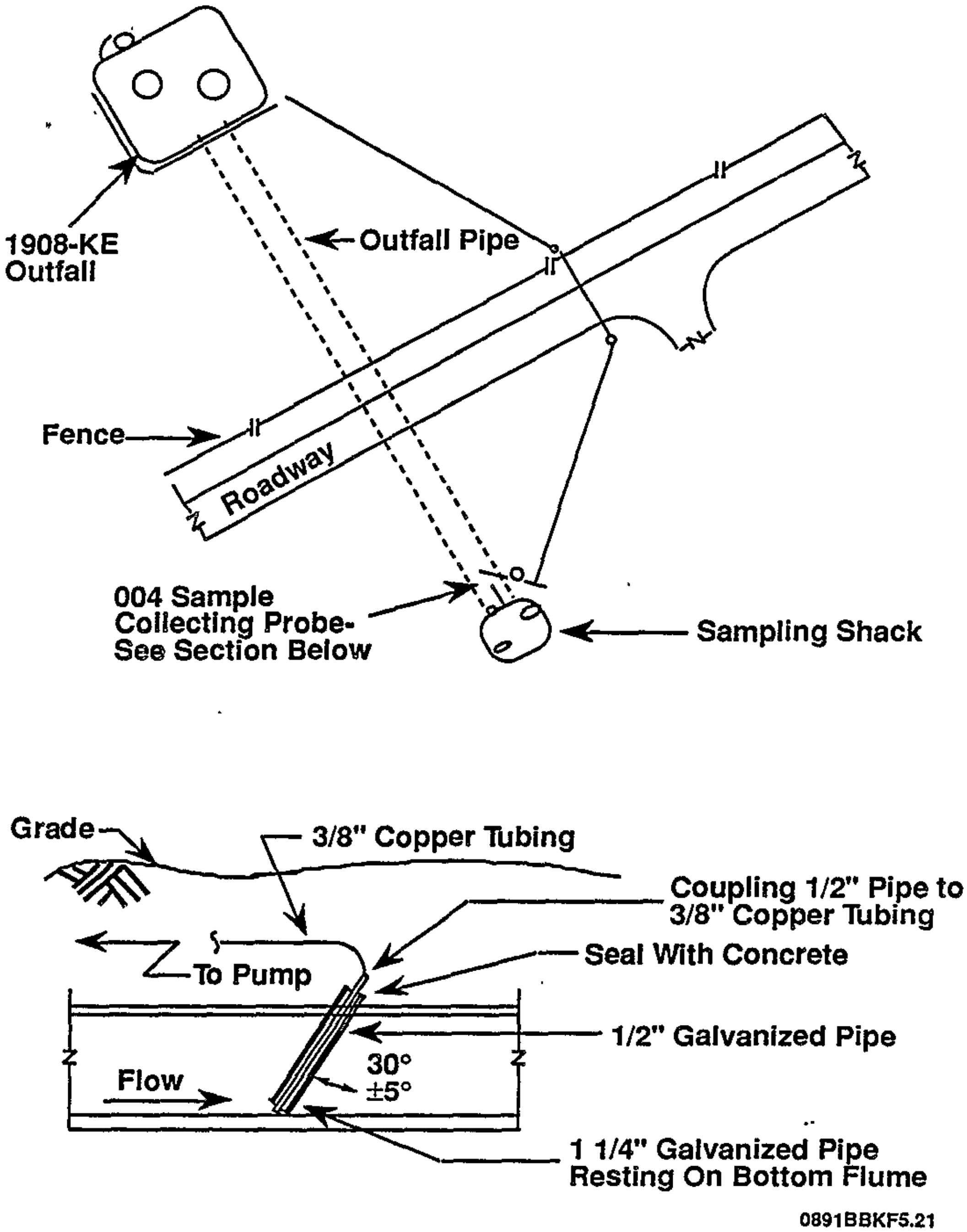


Figure 5-21. 1908-KE Monitoring Schematic.



6.0 EFFLUENT MONITORING/SAMPLING SYSTEM DESIGN CRITERIA

The 100-K Area facility effluents are routinely sampled to obtain the data necessary for determining regulatory compliance. Both airborne and liquid effluent streams with the potential for containing contaminants are sampled for radioactivity, pollutants, and other hazardous material.

6.1 AIRBORNE EMISSION SAMPLING SYSTEM DESIGN

Currently, the same type of system is used for monitoring/sampling the airborne emissions from both the 105-KE and 105-KW basin exhausts. The 1706-KEL exhaust and the 1706-KER exhausts have slightly different sampler configurations.

The system for determining radiological contaminants in the airborne emissions is a fixed airborne effluent sampling system. This system consists of a vacuum pump which draws a sample of the air discharge through a 47-mm particulate sample cartridge. The samplers on 105-KE/KW use a 1/4 horsepower (hp) Gast* Integral Vacuum Pump and the samplers at 1706-KEL and 1706-KER use a 1/4 hp Dia-Vac** Vacuum Pump. All four sample cartridges contain 47-mm glass fiber filters for trapping particulates. The cartridges used in the 105-KE and 105-KW basins have the capability for containing charcoal filters. The charcoal filters were used for determining iodine releases. Because radioiodine has a short half-life and is not a problem, these charcoal filters are no longer in use.

The samplers on the 105-KE and 105-KW basins and the 1706-KEL exhaust are equipped with vacuum gauges for indirect determination of sample flow rate. The 1706-KER and 1706-KEL sampling systems incorporate rotameters to provide direct readout of sampler air flow.

The sampling systems used for the evaluation of airborne effluents from the 100-K Area consists of a 1/4 hp vacuum pump and a particulate sampler. The 105-KE exhaust system and the 105-KW exhaust system are continuous samplers while the other sampling systems operate only when the exhaust systems are working. In all of these systems, the air to be sampled is drawn through the probe and transport line to the sample cartridge by a 1/4 hp vacuum pump.

In addition to the above, the 1706-KEL Exhaust system has instrumentation indicating exhaust flow data.

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*Gast is a registered trademark of the Gast Manufacturing Corporation.
**Dia-Vac is a registered trademark of Dia-Vac Air Dimensions, Inc.

The particulate samples are collected and analyzed from the sample location as follows:

- 105-KE Basin Exhaust - Weekly
- 105-KW Basin Exhaust - Weekly
- 1706-KEL Exhaust - Collected monthly, analyzed quarterly
- 1706-KER Exhaust - Collected monthly, analyzed quarterly.

6.2 LIQUID EFFLUENT SAMPLING SYSTEM DESIGN

Two liquid effluent sampling systems that are in use at the 100-K Area are for obtaining discharge data during operation. NPDES Outfall 003 is an intermittent discharge from the 181-KE Intake Structure filter screen backwash. Grab samples are taken during discharge. The 1908-KE Outfall (or NPDES Outfall 004), is a continuously sampled outfall equipped with a continuous composite sampling system.

The sampling system on Outfall 004 consists of a V-notch weir structure for measuring flow and a composite sampler. A sample is collected when a small aliquot of the effluent stream is piped into a sample container. When a preselected quantity of liquid has been discharged, the composite sample is collected and sent to a laboratory for radionuclide analysis. This sample is collected monthly. Grab samples can be obtained from the system if the continuous composite sampling system is not operational. Grab samples are used for NPDES permit compliance (EPA 1981).

Because Outfall 003 discharges are intermittent, continuous sampling is not required. When the outfall is operated the discharge is grab sampled to comply with the NPDES permit.

A complete listing of the physical dimensions and equipment installed at each effluent monitoring point is given in Section 16.5, Release Point Specifications.

7.0 CHARACTERIZATION OF CURRENT EFFLUENT MONITORING SYSTEM

7.1 INSTRUMENT DESCRIPTION

7.1.1 Air Sampling Equipment

The air sampling equipment at both the KE and KW Basins and at 1706-KER and 1706-KEL consists of the following:

- Sampling tubes leading from the release point to a sample cartridge
- A sample filter cartridge, containing a 47-mm glass fiber filter, is used to collect particulates. The cartridges used in the basins are also capable of containing charcoal filters for collecting iodines. However, because of their decay time, iodines are no longer present in airborne effluents and the charcoal filters are not in use
- Rotameters for measuring flow rate through the sampling system and systems for measuring ventilation flow
- A vacuum sample pump, used for pulling air through the sampling system.

7.1.2 Water Sampling Equipment

While Outfall 003 is grab sampled, Outfall 004 has continuous, composite sampling capability. The composite sampler for Outfall 004 is housed within a small building located approximately 100 yd inland of the 1908-KE Outfall. An aliquot is taken from a small stream supplied to the composite sampler by a Berkeley* Model 778 sample pump. The composite sampler is a Collins Model 40-1P2. The sample pump pulls approximately 1 gal/min from the outfall pipe. The compositing component diverts a small aliquot from this stream. The aliquots are collected in the sample bottle and the size of the aliquot is adjusted to ensure the proper sample size for the required monitoring frequency.

The Outfall 003 grab sample is taken when the outfall is in operation. A grab sample is obtained from Outfall 004 for NPDES permit compliance determination.

7.2 INSTRUMENT SPECIFICATIONS

Detailed instrument and physical dimensions of effluent release points are given in Section 16.5.

*Berkeley is a registered trademark of Sta-Rite Industries, Inc.

7.2.1 Air Sampling/Monitoring Equipment

7.2.1.1 Flow Monitoring Equipment. Instrumentation is in place to provide flow measurement through the exhaust points. Equivalent instrumentation is also provided on the sampling systems. This provides a means for determining that a representative sample of air is being obtained from the exhaust. Using the data obtained from the instruments, the total radioactivity from a release point can be accurately determined.

7.2.1.2 Sample Collection Equipment. Each sampler has a filter cartridge for the collection of particulate radionuclides being released from the exhaust.

7.2.1.3 Calibration Requirements. Current procedure requires annual instrument calibration. Instrumentation calibration is performed in accordance with Westinghouse Hanford procedures, and ANSI/American Society of Mechanical Engineers (ASME) standards. Laboratory instrumentation are calibrated in accordance with the laboratory QA requirements.

7.2.2 Liquid Sampling/Monitoring Equipment

7.2.2.1 Flow Monitoring Equipment. Outfall 004 is equipped with instrumentation that will determine the total flow from the release point. The sampler has instrumentation for determining the flow rate and computing the proportional sample to be taken from the liquid effluent.

7.2.2.2 Sample Collection Equipment. Sample collection equipment provides representative samples from the outfalls. The sampling lines and equipment are constructed from materials that will not contribute to contamination, react with any possible constituents, or degrade the integrity of the sample.

7.2.2.3 Calibration Requirements. Current procedure requires annual instrument calibration. Instrument calibration is performed in accordance with Westinghouse Hanford procedures and ANSI/ASME standards. Laboratory instrumentation are calibrated in accordance with the laboratory QA requirements.

7.3 ALTERNATE MONITORING AND ASSESSMENT METHODS

7.3.1 Alternate Air Monitoring and Assessment Method

All of the airborne effluent sampling systems at 100-K use similar equipment. The systems consist of a particulate filter which is housed in a standard environmental air sampling cartridge for the basins, and in a modified cartridge for 1706-KEL and 1706-KER. The air being sampled is drawn into the cartridge by a vacuum pump. Currently, the pump used in the systems at 105-KE/KW is a Gast Model 0522-V103-G18DX which is rated at 1 ft^3/min flow at a minimum of 13 in. Hg vacuum. The pump used at 1706-KEL and 1706-KER is a Dia-Vac Model 19320T. The pumps are connected to the sample probes by stainless steel sample transport lines.

In the event of a vacuum pump failure, the preferred corrective action is to replace the failed pump with either the same or the equivalent equipment, as shown in the table below. The maintenance of spare vacuum pumps will provide the ability to restore a failed system rather than resort to an alternate system. Should a sampling system failure occur in the sample transport line, the alternative is to take portable grab air samples until the line can be replaced.

Effluents	Primary Sample	Corrective Action
105-KE Basin	Standard environmental sampler with 1/4 hp vacuum pump	Replace with spare
105-KW Basin	Standard environmental sampler with a 1/4 hp vacuum pump	Replace with spare
1706-KEL	Standard environmental sampler with a 1/4 hp vacuum pump	Replace with spare
1706-KER	Standard environmental sampler with 1/4 hp vacuum pump	Replace with spare

7.3.2 Alternate Liquid Effluent Monitoring and Assessment Method

The liquid effluent sampling system consists of a continuous composite sampler for Outfall 004 and grab samples for Outfall 003. Flow of the liquid effluent discharge is monitored by a continuous flow recorder. The continuous composite sampler samples the effluent discharge stream prior to discharge.

The grab samples are random 1 gal samples taken at the discharge point.

In the event that the continuous composite samplers fail, grab samples would be taken daily and composited until the automatic samplers could be repaired. If the flow totalizer fails on the smaller discharges, an alternate method will be used to determine the flow rate until the flow totalizer is repaired or replaced. In the event of a failure of the flow monitor, the corrective action is to replace the failed component.

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8.0 HISTORICAL MONITORING/SAMPLING DATA FOR EFFLUENT STREAMS

8.1 NORMAL CONDITIONS

The 100-KE/KW reactor facilities were constructed in the early to mid 1950's and operated until 1971. The facilities were retired, deactivated and decontaminated. The 105-KE/KW fuel storage basins were modified for the interim storage of N Reactor irradiated fuel. Actual storage of the N Reactor irradiated fuel began in 1975 and continues to the present day. The last shipment of N Reactor irradiated fuel to the basins occurred in 1989.

From 1975 through the early 1980's, normal 100-K Basin operations included the receipt of irradiated fuel from N Reactor, the shipment of irradiated fuel to PUREX for processing, and periodic segregation of selected fuel elements. Modifications to the 100-K basins continue in order to make the basins more environmentally acceptable.

The 1706-KE facility houses the KEL and the KER facilities. The KEL and KER have been used to support N Reactor startup, K Reactor shutdown and N Reactor standby. Currently development work with hazardous treatment systems is being conducted in the building.

8.1.1 Effluent Releases

Since the change of the 100-K area status from operating reactors to irradiated fuel storage, pre-1971 effluent monitoring results and techniques are considered to be non-germane for the 100-K Area Fuel Storage Basins and Engineering Laboratory FEMP. The majority of the work after 1975 concerned irradiated fuel storage and manipulation and transfer of the fuel. The basins vent airborne effluent directly to the atmosphere while the 1706-KE facility vents airborne effluent through a filter system.

Radiological and chemical effluents from the 100-K Area facilities were reviewed to determine the potential for release of hazardous waste. As a result of these reviews, it was concluded that only the radiological effluent releases and NPDES permitted effluents merit consideration.

Table 8-1 lists the 100-K area radioactive airborne and liquid effluent discharge totals for the years 1981 to 1989. The year 1989 was selected as the most representative of the radionuclide releases because the last of N Reactor irradiated fuel was transferred into the basins and the area stabilized.

The 100-K area has a total of six monitored effluent discharge points, four airborne effluent discharge points and two liquid effluent discharge points. The airborne discharge points are the 105-KE and 105-KW exhaust vents, and the 1706-KEL and 1706-KER exhaust vents. The 105-KE/KW monitored exhaust discharge points are approximately 42 ft above the ground. These release points are unfiltered.

Table 8-1. K Area Airborne Emissions and Liquid Effluents 1981-1989. (Ci)

Airborne Releases									
	1981	1982	1983	1984	1985	1986	1987	1988	1989
105-KE	6.26 E-03	1.22 E-03	1.72 E-03	2.29 E-03	1.31E-03	2.85 E-04	7.44 E-04	1.64 E-04	1.25 E-04
105-KW	NA[a]	NA	7.39 E-05	4.18 E-04	1.18E-04	9.64 E-05	6.71 E-05	9.23 E-05	5.74 E-05
1706-KEL	5.54 E-06	6.40 E-06	3.64 E-06	1.38 E-07	5.96E-07	1.14 E-05	7.30 E-06	3.62 E-06	3.21 E-06
1706-KER	NA[a]	NA	NA	NA	NA	NA	NA	NA	1.71 E-06
TOTAL	6.26 E-03	1.22 E-03	1.8 E-03	2.71 E-03	1.43E-03	3.93 E-04	8.18 E-04	2.60 E-04	1.88 E-04
Liquid Releases									
	1981	1982	1983	1984	1985	1986	1987	1988	1989
1908-KE	7.79 E-02	7.54 E-02	7.72 E-02	3.44 E-02	3.48 E-02	2.43 E-02	4.36 E-02	2.95 E-02	3.4 E-01

Source: Fogel (1982, 1983), Rokkan (1984, 1985, 1986, 1987, 1990b, 1991)

[a]Release quantities not available

The 1706-KEL and KER monitored discharge points are 25 ft and 10 ft above the ground, respectively. The KEL and KER exhausts through HEPA filters prior to being released to the environment.

The liquid effluent discharge points for the 100-K area are NPDES permitted locations (EPA 1981). The 1908-K outfall is identified as NPDES Outfall 004 and the 181-KE Filter Screen Backwash discharge is identified as NPDES Outfall 003. Historical radioactive airborne and liquid effluent discharge data are included in Tables 8-2 through 8-6. No radioactive effluent has been measured at NPDES Outfall 003.

8.2 UPSET CONDITIONS

The operational FEMP determination for the 100-K Area fuel storage basins and engineering laboratory (WHC 1991b) provided a rationale and justification for the maximum credible upset conditions for the 100-K area. By reviewing environmental release data it was determined that the 1981 and 1984 fuel handling conditions caused upset conditions and subsequently released the highest amounts of airborne radioactivity to the environment (Table 8-1).

Using Table 8-1 as a reference point, several conservative assumptions were made to project the maximum credible upset condition.

These assumptions include the following:

1. 1.0×10^{-03} of the Ci in the failed fuel in the basin is released to the basin water.

2. 1.0×10^{-06} of the radionuclides in the basin are released to the atmosphere over a period of 1 yr.

3. The fuel at KE has been stored for 4 yr and the fuel at KW has been stored for 12 yr.

4. All stored fuel has undergone radioactive decay in their respective basins.

5. One percent of the basin water is released directly to the Columbia River over a period of 1 yr.

The 100-K Area airborne dose assessment for the upset release was performed using the CAP-88 (Beres 1990) unit dose conversion factors provided by PNL, and dose assessment for the liquid upset condition was performed using the PNL GENII (Napier et al. 1988) unit dose conversation factors. The results give the maximum airborne dose to an individual located 9,900 m west of K Area and the maximum liquid dose to an individual located at Ringold, Washington.

Tables 8-7 and 8-8 show the comparison of the calculated doses as a result of 100-K Area operations during 1989.

Table 8-2. 105-KER Airborne Effluent Release.

ISOTOPE	CI (1989)	MON. TYPE	SPLE. PT.	INSTR. MDA	REQ. MDA	AVE. CONC.	HIGH CONC.
^{60}Co	1.00 E-06	NA	EXHAUST	NA	NA	2.60 E-14	NA
^{90}Sr	2.10 E-08	NA	EXHAUST	NA	NA	9.00 E-16	NA
^{134}Cs	NA	NA	EXHAUST	NA	NA	NA	NA
^{137}Cs	6.90 E-07	NA	EXHAUST	NA	NA	4.00 E-10	NA
^{238}Pu	5.50 E-01	NA	EXHAUST	NA	NA	1.50 E-17	NA
^{239}Pu	1.80 E-09	NA	EXHAUST	NA	NA	4.80 E-17	NA

Source: Rokkan (1991)

Table 8-3. 105-KW Airborne Effluent Release.

ISOTOPE	CI (1989)	MON. TYPE	SMPL. PT.	INSTR. MDA	REQ. MDA	AVE. CONC.	HIGH CONC.
^{60}Co	3.30 E-05	NA	VENTS	NA	NA	8.20 E-14	NA
^{90}Sr	4.10 E-07	NA	VENTS	NA	NA	1.00 E-15	NA
^{134}Cs	NA	NA	VENTS	NA	NA	NA	NA
^{137}Cs	2.40 E-05	NA	VENTS	NA	NA	6.10 E-14	NA
^{238}Pu	6.00 E-09	NA	VENTS	NA	NA	1.50 E-17	NA
^{239}Pu	1.10 E-08	NA	VENTS	NA	NA	2.90 E-17	NA

Source: Rokkan (1991)

Table 8-4. 105-KE Airborne Effluent Release.

ISOTOPE	CI (1989)	MON. TYPE	SMPL. PT.	INSTR. MDA	REQ. MDA	AVE. CONC.	HIGH CONC.
^{60}Co	3.70 E-05	NA	VENTS	NA	NA	9.30 E-14	NA
^{90}Sr	1.90 E-05	NA	VENTS	NA	NA	4.70 E-14	NA
^{134}Cs	2.50 E-05	NA	VENTS	NA	NA	6.30 E-14	NA
^{137}Cs	4.40 E-05	NA	VENTS	NA	NA	1.10 E-13	NA
^{238}Pu	5.90 E-08	NA	VENTS	NA	NA	1.40 E-16	NA
^{239}Pu	3.20 E-07	NA	VENTS	NA	NA	8.00 E-16	NA

Source: Rokkan (1991)

Table 8-5. 1706-KE Laboratory Airborne Effluent Release.

ISOTOPE	CI (1989)	MON. TYPE	SMPL. PT	INSTR. MDA	REQ. MDA	AVE. CONC.	HIGH CONC.
^{60}Co	3.20 E-06	NA	EXHAUST	NA	NA	1.80 E-15	NA
^{90}Sr	NA	NA	EXHAUST	NA	NA	NA	NA
^{134}Cs	NA	NA	EXHAUST	NA	NA	NA	NA
^{137}Cs	NA	NA	EXHAUST	NA	NA	NA	NA
^{238}Pu	2.40 E-09	NA	EXHAUST	NA	NA	1.40 E-17	NA
^{239}Pu	3.00 E-09	NA	EXHAUST	NA	NA	1.70 E-17	NA

Source: Rokkan (1991)

Table 8-6. 1908-K Outfall Liquid Effluent.

ISOTOPE	CI (1989)	MON. TYPE	SMPL. PT.	INSTR. MDA	REQ. MDA	AVE. CONC.	HIGH CONC.
^{3}H	2.60 E-01	NA	004	NA	NA	1.20 E-07	NA
^{60}Co	6.60 E-02	NA	004	NA	NA	2.90 E-08	NA
^{90}Sr	1.00 E-03	NA	004	NA	NA	4.30 E-10	NA
^{137}Cs	1.00 E-02	NA	004	NA	NA	4.60 E-09	NA
^{239}Pu	9.20 E-06	NA	004	NA	NA	4.10 E-12	NA

Source: Rokkan (1991)

Table 8-7. K Area Normal Operation Dose Assessment for Airborne Emissions - 1989.

Release Point	Release (Ci)	Effective Dose Equivalent (mrem)	
		CAP-88[a]	GEN II[b]
105-KE	1.25 E-04	1.0 E-05	8.8 E-06
1706-KEL	3.21 E-06	2.0 E-07	1.1 E-07
1706-KER	1.71 E-06	9.8 E-08	6.9 E-08
105-KW	5.74 E-05	2.5 E-06	1.7 E-06

[a]Moore et al. (1979)
[b]Napier et al. (1988)

Table 8-8. K Area Normal Operation Dose Assessment for Liquid Effluents - 1989.

Release Point	Release[a] (Ci)	Effective Dose[a] Equivalent (mrem)
1908-KE Outfall	3.4 E-01	3.4 E-03

[a]Napier et al. (1988)

9 2 1 2 ? 2 ? 7 1

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9.0 SAMPLE ANALYSIS

The effluent monitoring and analysis plan was developed specifically for the 100-K Area and intended to monitor the 105-KE/KW Fuel Storage Basins, the 1706-KEL Engineering Laboratory, and the 1706-KER Recirculation Building effluents and provide valid sample results during operations.

9.1 PURPOSE

The purpose of the 100-K Area effluent monitoring and analysis program is to provide representative samples and accurate analysis of the facilities' effluents to establish the proper documentation and reports. The documentation and record keeping will enable the facility to demonstrate that it meets applicable DOE Orders and the regulations of federal, state and local agencies.

9.2 BACKGROUND

The 100-K Area has been operating an effluent monitoring program since the 100-K Reactors began operation. When the reactors were deactivated and decontaminated, this monitoring program was no longer necessary. When the storage basins began to be used for the storage of N Reactor irradiated fuel, sampling was again established.

9.3 SAMPLING SCHEDULE, FREQUENCY AND STRATEGY

9.3.1 Air Sampling Schedule, Frequency and Strategy

The K Area airborne emissions are sampled at the effluent release points, as shown in Table 9-1.

The selection of air monitoring equipment, method and frequency is based on the calculated maximum offsite EDE as recommended in the effluent monitoring regulatory guide (DOE 1991) and the estimated dose from the actual airborne effluents released by the facility in 1989. The selection of the equipment is based on the effluent regulatory guide and past effluent sampling performed routinely for insignificant doses approaching background. The selection of effluent monitoring equipment, method, and frequency is based on the following criteria:

Effluent Monitoring Method	Max. Annual Offsite Dose
Continuous On/Off line Monitor	>0.1 mrem/yr
Continuous Sampling Weekly	>0.01 mrem/yr
Continuous Sampling Monthly	>0.0001 mrem/yr
Continuous Sampling Quarterly	>0.000001 mrem/yr

Table 9-1. Air Sampling and Analytical Requirements.

LOCATION	REASON FOR SAMPLING	SAMPLING FREQUENCY	SAMPLING METHOD	SAMPLE ANALYSIS REQUIREMENTS
EFFLUENT RELEASE POINTS- SAMPLING REQUIRED				
105-KE BASIN EXHAUST	RADIOACTIVITY	WEEKLY	1.2 ft^3/min Air Pump with 47-mm particulate filter	Gross Alpha & Beta, Gamma Scan (0.05-2.0 MeV) ^{90}Sr, ^{238}Pu, $^{239,240}Pu$, ^{3}H and gaseous monitor for noble gases
105-KW BASIN EXHAUST	RADIOACTIVITY	WEEKLY	1.2 ft^3/min Air Pump with 47-mm particulate filter	Gross Alpha & Beta, Gamma Scan (0.05-2.0 MeV) ^{90}Sr, ^{238}Pu, $^{239,240}Pu$, ^{3}H and gaseous monitor for noble gases
1706-KEL EXHAUST	RADIOACTIVITY	QUARTERLY	1.2 ft^3/min Air Pump with 47-mm particulate filter	Gross Alpha & Beta, Gamma Scan (0.05-2.0 MeV) ^{90}Sr, ^{238}Pu, $^{239,240}Pu$, ^{3}H and gaseous monitor for noble gases
1706-KER EXHAUST	RADIOACTIVITY	QUARTERLY	1.2 ft^3/min Air Pump with 47-mm particulate filter	Gross Alpha & Beta, Gamma Scan (0.05-2.0 MeV) ^{90}Sr, ^{238}Pu, $^{239,240}Pu$, ^{3}H and gaseous monitor for noble gases

9.3.2 Water Sampling, Schedule and Frequency

Water sampling is to be performed at the liquid effluent discharges to the Columbia River. The sampling locations, flow monitoring, sampling frequency, sample size, sampling method and analytical requirements are shown in Table 9-2.

9.4 SAMPLE ANALYSIS, DETECTION AND ACCURACY

9.4.1 Air Samples

Air samples are collected at four effluent release points as shown in Table 9-1. All the air samples collected are particulate samples from continuous air samples. The air samples are analyzed for radionuclides according to the list of analyses shown in Table 9-3. Because no short lived isotopes are present, the analytical scheme for air samples is primarily concerned with identifying the long lived activation and fission isotopes and determining the concentration of the specific radionuclide being emitted. The analyses listed in Table 9-3 are based on the radionuclides potentially present in the fuel in the KE and KW Basins and in minor amounts in 1706-KEL and KER.

The minimum detectable concentrations (MDC) for the specific radiochemical analyses are shown in Table 9-3. The MDCs for the air samples are very low due to the large sample size of 800 to 1500 cu m. An MDC of this magnitude will readily detect radionuclides at or near background levels for specific radionuclides.

The accuracy for the analyses is ± 25%. The accuracy and the precision of the various analytical methods are verified by a daily check source, sample blanks and spiked samples.

9.4.2 Water Samples

Water samples are taken from the liquid effluent monitoring points shown in Table 9-2 to fulfill DOE, EPA, and Washington State requirements for monitoring radioactivity and NPDES discharges. The samples are then analyzed for the radionuclides and NPDES required substances as shown in Table 9-4. The table shows the location, reason for sampling, flow monitoring, frequency of sampling, analysis to be performed, sample size, and sampling method.

The minimum detection limits for the radionuclide for the liquid effluent samples are given in Table 9-4. The table shows the analysis of the radionuclide, and the sample type, sample size, analytical method, MDC, and the accuracy of the method. The analytical methods used in this EMP are from EPA SW-846 (EPA 1986), Westinghouse Hanford's 222-S Laboratory procedures, or contract laboratory procedures authorized by the OSM.

Table 9-2. Liquid Effluent Sampling and Analytical Requirements.

				Frequency of Sampling		Analysis/ Measurement		
Location	Reason for Sampling	Flow Monitoring	Radio-activity	NPDES	Radioactivity	NPDES	Sample Size/Type	Sampling Method
1908-KE (Outfall 004)	Radioactivity NPDES OSR	Continuous Flow Monitoring	Monthly	Weekly	$^{239,240}Pu$, ^{3}H, Gamma Scan	Temperature, Free Available Chlorine, pH, Total Suspended Solids	4 L composite	Continuous Composite Sample/Grab
181-KE (Outfall 003)	NPDES			Monthly		Total Suspended Solids	1 L	Grab

Table 9-3. Radiochemical Analytical Methods And Limits For Airborne Samples.

RADIO CHEMICAL	SAMPLE TYPE	SAMPLE SIZE	ANALYTICAL METHODS	MINIMUM DETECTABLE CONCENTRATION	ACCURACY (+/-)
Gross Alpha	Air Particulate	800 m^3	9310[a]	0.003 pCi/m^3	25%
Gross Beta	Air Particulate	800 m^3	9310[a]	0.001 pCi/m^3	25%
Tritium	Air (Moisture)	50 mL	LA-218-111[b]	50 pCi/m^3	25%
Gamma Scan (0.05-2.0 MeV) ^{40}K, ^{54}Mn, ^{58}Co, ^{60}Co, ^{59}Fe, ^{65}Zn, $^{95}ZrNb$, ^{99}Mo, ^{134}Cs, ^{137}Cs, ^{152}Eu, ^{154}Eu, and ^{155}Eu	Air Particulate	1500 m^3	LA-548-121[b]	0.01 pCi/m^3	25%
^{90}Sr	Air Particulate	1500 m^3	ESM-697/687[b]	0.001 pCi/m^3	25%
$^{238,239,240}Pu$	Air Particulate	1500 m^3	ESM-D578[c]	0.000025 pCi/m^3	25%
^{85}Kr	TBD	TBD	TBD	TBD	TBD

[a] These procedures are SW-846 procedures (EPA 1986).
[b] These procedures are 222-S procedures.
[c] These procedures are EPA radionuclide analytical procedures (EPA 1984).

Table 9-4. Radiochemical Analytical Methods And Limits For Liquid Effluents.

RADIO CHEMICAL	SAMPLE TYPE	SAMPLE SIZE	ANALYTICAL METHODS	MINIMUM DETECTABLE CONCENTRATION	ACCURACY (+/-)
Gross Alpha	Water	4 L	9310[a]	4 pCi/L	25%
Gross Beta	Water	4 L	9310[a]	4 pCi/L	25%
Tritium	Water	1 L	LA-218-111[b]	50 pCi/L	25%
Gamma Scan (0.05-2.0 MeV)	Water	4 L	LA-548-121[b]	8 pCi/L	25%
^{90}Sr	Water	4 L	ESM-697/687[c]	0.06 pCi/L	25%
^{238}Pu	Water	4 L	ESM-D578[c]	0.01 pCi/L	25%
$^{239,240}Pu$	Water	4 L	ESM-578[c]	0.01 pCi/L	TBD

[a] These procedures are SW-846 procedures (EPA 1986).
[b] These procedures are 222-S procedures.
[c] These procedures are EPA radionuclide analytical procedures (EPA 1984).

The accuracy of the analytical methods are determined as part of the overall calibration procedure and are checked on a daily basis through the use of calibration check sources, sample blanks, spiked samples, and split samples which are part of the overall laboratory QC program.

9.5 CALIBRATIONS FOR SAMPLING AND ANALYSIS

9.5.1 Air Sampling Equipment

Air sampling equipment is initially calibrated for flow prior to its being used and recalibrated annually by the Office of Support Services (OSS). The flow rate for the sampling equipment is checked periodicly with a rotameter and the observed value is logged by the Health Physics technician.

9.5.2 Water Sampling Equipment

Continuous water sampling equipment is initially calibrated and anually recalibrated for the rate of flow by the OSS group. The flow rate for the water sampling equipment is checked on a weekly basis by the plant's operating personnel.

9.5.3 Field and Laboratory Instruments

Field and laboratory instruments are initially calibrated and annually recalibrated. The instruments are calibrated by laboratory and instrument personnel in accordance with both N Reactor's and the laboratory's calibration programs.

9.6 EFFLUENT DATA CALCULATIONS

9.6.1 Air Samples

The 100 Area Environmental Protection and the 100 Area Environmental Assurance currently estimates the flow rate and the volume of air released from the various air emission points by using the maximum fan ratings. The 100 Area Environmental Protection also receives the laboratory airborne radionuclide sample results from the analytical laboratory. From this information, 100 Area Environmental Protection calculates the airborne concentrations, determines the annual release, and compares the effluent to DOE's DCGs. To allow the methods and data to be reviewed, the 100 Area Environmental Protection maintains a file on how these calculations have been performed historically.

9.6.2 Water Samples

The liquid effluent discharge information and water samples are maintained and collected by the plant operators. The EPA obtains the discharge information from the operators and determines, in conjunction with laboratory results, the average and maximum concentration of the radionuclides discharged and the annual discharge. As with air samples, the 100 Area Environmental Protection maintains a file on water sample calculations to allow the methods and data to be reviewed.

9.7 DATA VALIDATION AND VERIFICATION

9.7.1 Data Validation

Data validation, conducted by the OSM or N Reactor Operations Assessment, is performed by reviewing the sampling information provided by Health Physics, Plant Operations, and the Analytical Laboratory. The sample collection data is reviewed for the correct sample number, sample volume, sampling time, flow rate, date sample started, date sampling ended, and date transported. The data is also reviewed to determine if the sampling was properly reviewed and signed off by the responsible supervisor.

In addition, the laboratory report is reviewed by OSM to ensure that the sample results sent by the laboratory are the result of analyzing the 100-K Area samples. The laboratory results are cross checked with the sample collection information to validate the sample to the results. The sample results or the report are reviewed for the correct sample identification location, type of sample, date of analysis, and the signature of the laboratory manager.

9.7.2 Data Verification

The verification of field and laboratory analytical data will be validated by the maintenance of a field and laboratory instrument verification program that contains the following elements. The calibration of field and laboratory instruments will have a program to verify the linearity of instrument calibration on a annual basis. The program will have a calibration check source reading that must be within the 95% confidence interval. The data verification program will provide for sample blanks and spiked samples on a routine basis to ensure the analytical instrument being used maintains its linearity calibration curve within the 95% confidence interval. Part of the data verification is to determine if the data meets the requirements of the K FEMP. Data from the effluent monitoring and sampling program will be assessed by OSM and 100 Area Environmental Protection.

Further data verification is also performed by the 100-Area Environmental Assurance department.

9.8 SAMPLE SHIPPING AND CUSTODY

9.8.1 Sample Shipping

The various types of effluent samples from 100-K Area are to be packaged and shipped from 100-K to the various laboratories under the following packaging and shipping procedure:

- Managing, Packaging and Shipping Waste Samples, Procedure No. HRWC-03, *Hazardous and Radiological Waste Control Manual*, WHC-NR-M-12 (WHC 1990c).

The above procedure ensures that waste and effluent samples that are packaged and shipped to either Hanford Site Laboratories or offsite laboratories meet the packaging and shipping requirements of DOE, NRC, the Department of Transportation (DOT), and Washington State.

9.8.2 Sample Custody

Effluent samples from the 100-K Area are transported to the laboratory under an administrative chain-of-custody procedure entitled Sample Chain-of-Custody, Procedure No. HRWC-12 contained in the *Hazardous and Radiological Waste Control Manual*, WHC-NR-M-12.

The purpose of the procedure is to create an accurate written record which can be used to trace the possession and handling of a waste sample in the process of being characterized. This procedure fulfills the State of Washington requirements in *Dangerous Waste Regulations*, WAC 173-303 (WAC 1989).

9.9 EFFLUENT MONITORING RECORDKEEPING

Two types of records that are kept to ensure that all applicable recordkeeping requirements are met are sample records and result records. Sample records ensure that samples are taken in a timely manner and handled properly. Result records assist in preparing environmental release reports as required by DOE, EPA, Washington State Department of Ecology (Ecology), and Westinghouse Hanford.

9.9.1 Sample Records

All samples must be taken in a timely and proper manner and records must be maintained, demonstrating the proper scheduling for each sample. Chain-of-custody records must be kept to ensure that the samples have not been altered or tampered with in any way. Because these records will be used to verify regulatory compliance, the regulations require that each sample have a record indicating the status of the collection, transfer, analysis, storage, and disposal. To help the integration of the recordkeeping with the program implementation, the K-Basin operations group maintains the records for the samples.

9.9.2 Result Records

Copies of sample test results will be maintained by 100 Area's Environmental Protection. This group is responsible for preparing and issuing the yearly environmental release report for the 100 Area.

9.10 EFFLUENT REPORTS

The 100 Area's Environmental Protection is responsible for preparing all reports required by DOE, EPA, and Ecology. The reports for DOE include occurrence notification reports as well as the annual release reports. These reports shall be produced in accordance with the requirements set forth in DOE 5400.1, Chapter II (DOE 1988a). Reports submitted to EPA and Ecology will be in the format requested by the respective agency.

9.11 EFFLUENT MONITORING PROCEDURES

The facility effluent monitoring program is conducted by using approved procedures. Effluent monitoring sampling procedures used for the ongoing activities are shown in Table 9-5.

9.12 TRAINING

Sampling training for the airborne portion of the effluent monitoring program is conducted for the Health Physics technicians as part of the Health Physics technician training program. Training for the technicians is conducted initially, and later as needed to maintain or upgrade the technicians' skills.

Sampling training for the liquid effluent portion of the effluent monitoring program is conducted for the plant operations personnel who have primary responsibility for conducting the liquid effluent portion of the sampling program. Operator training is conducted on an annual basis.

Training of analytical laboratory personnel is conducted by the Westinghouse Hanford manager of the 222-S Laboratory. If the analytical laboratory work is conducted by an offsite laboratory, the appropriate contract requirements maintained by the OSM apply.

9.13 AUDITS AND APPRAISALS

Audits and Appraisals are conducted for the FEMP according to DOE Order 5482.1B (DOE 1987) and the corresponding RL Order (DOE-RL 1987). Audits and Appraisals are conducted for the K Area FEMP by the Environmental Assurance Department and N Reactor QA. The Environmental Assurance Department conducts functional appraisals, environmental audits, management appraisals, surveillance/compliance inspections, and environmental event reporting and noncompliance notifications. The Environmental Assurance program for carrying out the audits and appraisals is identified in the Environmental Compliance Verification Program, WHC-CM-7-6 (WHC 1989a).

Table 9-5. K Area Effluent Sampling Procedures.

Monitoring Procedures	Responsible Group	Procedure No.
Effluent Monitoring Administration	Plant Operations	TBD
Airborne Effluent Sample Collection	Health Physics	WHC-IP-0692[a]
Liquid Effluent Sample Collection (Auxiliaries and NPDES)	Plant Operations	TBD
Flow Monitor Calibration Procedures	Plant Operations	TBD
Effluent Sample Tracking	Hazardous and Radiation Waste Control	TBD
Sample Packaging and Shipping	Hazardous and Radiation Waste Control	TBD
Sample Chain of Custody	Hazardous and Radiation Waste Control	WHC-NR-M-12[b] HRWC-12
Effluent Data Entry for Air and Water	Environmental Protection	TBD
Effluent Dose Calculations	Environmental Safety	TBD
Effluent Data Validation Management (OSM)	OSM	TBD
Effluent Data Verification	OSM/100 Area Environmental Protection	TBD
Effluent Sample Recordkeeping and Reporting	Environmental Protection	TBD
Laboratory Analysis and Calibrations	222-S Laboratory/Contract Laboratory	Analyte Dependent (See tables 9-3. 9-4, and 9-5)

[a]Westinghouse Hanford (1991c)
[b]Westinghouse Hanford (1990c)

9.14 QUALITY ASSURANCE

The Quality Assurance Project Plan (QAPP) for the 100-K Area Fuel Storage Basins FEMP (WHC 1991d) shown in Section 12.0, was written to meet the requirements in EPA QAMS-005/80 (EPA 1983), and the QA requirements in EPA SW-846 (EPA 1986) and ASME NQA-1 (ASME 1989).

9.15 U.S. DEPARTMENT OF ENERGY ANALYTICAL AND LABORATORY GUIDELINES

The analytical and laboratory procedures for the FEMP activities are identified in the *Quality Assurance Project Plan for the Facility Effluent Monitoring Plan Activities* (WHC 1991d). General requirements for laboratory procedures, data analyses, and statistical treatment are addressed in the QAPP. Detailed descriptions of these requirements are given in each FEMP.

The following elements are identified in the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991).

Table 9-6. Laboratory Procedures.

Element	Documentation
Sample identification system	To be provided when complete
Procedures preventing crosscontamination	Contained in 222-S Laboratory Analytical Procedures (identified in QAPP WHC-EP-0446 Table 8-1)
Documentation of methods	Contained in 222-S Laboratory Analytical Procedures (identified in QAPP WHC-EP-0446 Table 8-1)
Gamma emitting radionuclides	See QAPP Table 8-1
Calibration	See QAPP Table B-1
Handling of samples	See QAPP Table 8-1
Analysis method and capabilities	See QAPP Table 8-1
Gross alpha, beta, and gamma measurements	See QAPP Table 8-1
Direct gamma-ray spectrometry	See QAPP Table 8-1
Beta counters	See QAPP Table 8-1
Alpha-energy analysis	See QAPP Table 8-1
Radiochemical separation procedures	To be provided when available
Reporting of results	To be provided when available
Counter calibration	See Table B-1, QAPP
Intercalibration of equipment and procedures	To be provided when available
Counter background	Contained in 222-S Laboratory Analytical Procedures (QAPP, Table 8-1)
Quality assurance	To be provided when available

Table 9-7. Data Analyses and Statistical Treatment.

Element	Documentation
Summary of data and statistical treatment requirements	To be provided when available
Variability of effluent and environmental data	To be provided when available
Summarization of data and testing for outliers	To be provided when available
Treatment of significant figures	To be provided when available
Parent-decay product relationships	To be provided when available
Comparisons to regulatory or administrative control standards and control data	To be provided when available
Quality assurance	To be provided when available

10.0 NOTIFICATION AND REPORTING REQUIREMENTS

10.1 ENVIRONMENTAL OCCURRENCE

10.1.1 5400.1 General Environmental Protection Program

DOE Order 5400.1 established mandatory environmental program requirements to ensure that DOE operations comply with all applicable environmental regulations (DOE 1988a). Chapter II of this order sets forth the requirements for environmental reports, environmental occurrences reports, annual reports and effluent reports.

The specific requirements of this order include the following:

- Notification of environmental occurrences - notifying DOE Headquarters Emergency Operations Center of significant nonroutine releases of pollutants or hazardous substances, and any releases requiring notification of EPA

- Office of Management and Budget Circular A-106 - requires that pollution abatement projects be reported in a 5-yr plan, with field organizations reportings sent annually

- Annual site environmental report - summary of environmental data to characterize site environmental management performance, confirm compliance with environmental standards, highlight significant programs and efforts

- Reports on radioactive effluent/onsite discharge/unplanned releases - radioactive effluent and onsite discharge data reports covering the previous calendar year.

10.1.2 5484.1 Environmental Protection, Safety and Health Protection Information Reporting Requirements

DOE Order 5484.1 establishes the requirements and procedures for the investigation of occurrences having Environmental Safety and Health (ES&H) protection significance (DOE 1983).

Chapter I lists the occurrence notification requirements and provides a summary of occurrences and when they must be reported.

Chapter II classifies the occurrence by severity, defines each type of occurrence and provides the standards for the investigation board and the investigation report.

Chapter IV provides requirements for ES&H protection reports not described in preceding chapters. It provides for the establishment of an unusual occurrence reporting system and lists examples of the general type of occurrences to be considered when implementing the system.

Chapter V provides the criteria for determining DOE property valuation and DOE losses.

10.1.3 5000.3A Occurrence Reporting and Processing of Operations Information

DOE Order 5000.3A establishes a system for reporting the operations information for DOE facilities and processing information appropriately for corrective actions (DOE 1990a). The order defines the occurrence classification time limit, the oral and written occurrence reporting times, and the responsible individuals. The order gives examples of the types of occurrences in three categories; emergency, unusual occurrence, and off normal event.

10.1.4 5400.5 Radiation Protection of the Public and the Environment

DOE Order 5400.5 establishes standards and requirements for operations of DOE facilities to protecting members of the public and the environment from undue risk from radiation exposure (DOE 1990b). The reporting requirements set forth in this order are located in Chapter I, Section 11, and Chapter II, Section 7.

The order requires the reporting of actual or potential exposures to members of the public which could result in either an excessive EDE from DOE sources in a year or exceeding any limit or not meeting any other requirement or legally applicable limit.

10.2 ENVIRONMENTAL PROTECTION AGENCY REGULATIONS

There are a number of federal environmental regulations which are applicable to effluent monitoring activities at 100-K Area Fuel Storage Basins and Engineering Laboratory. These regulations, published under 40 CFR, are promulgated under the authority of various environmental protection acts, and enforced by the EPA.

10.2.1 Clean Air Act of 1977

The notification and reporting requirements applicable to the 100-K Area for the CAA are all covered under 40 CFR 61, Subpart H, NESHAP (1989c). The reporting requirements applicable to The 100-K Area are contained in 40 CFR 61.94. The regulations provide for granting authority to the states for regulating airborne pollutants. The State of Washington has provided additional requirements, as set forth in WAC 173-400, *Washington Air Pollution Control Regulations* (WAC 1990).

The specific requirements of this section include an annual report (to be submitted to the EPA Headquarters and regional office) of the results of monitoring as recorded in DOEs Environmental Information Statement and dose calculations for the previous calendar year.

10.2.2 Clean Water Act of 1977

The requirements of the CWA apply to discharges to surface waters. This applies to the outfalls from 100-K Area, 1908-KE and 181-KE. The regulations for this act are promulgated under a NPDES permit. These regulations are designed to further the objectives the Federal Water Pollution Control Act (FWPCA). The specific requirements for reporting and notifications can be found in the NPDES Permit (EPA 1981) issued by the EPA. The specific requirements of this chapter as described in the NPDES permit No. WA-000374-3 include:

- Routine Reporting - This includes the monthly discharge monitoring report submitted by the 14th day of the following month on EPA form No. 3320-1
- Nonroutine Reporting - This includes 24 h notice of noncompliance and other noncompliance reports as required.

10.2.3 Comprehensive Environmental Response, Compensation and Liability Act of 1980 and Superfund Amendments and Reauthorization Act

The applicable requirements of CERCLA are promulgated under the regulations published in 40 CFR 302 (EPA 1989a). These regulations are designed to provide for the efficient, coordinated, and effective response to releases into the environment of hazardous substances, pollutants, or contaminants which may present imminent danger to public and environmental health. The notification requirements are contained in 40 CFR 302.6. This includes immediate notification of a release of a hazardous substance exceeding the reportable quantity value.

The applicable requirements of SARA are promulgated in the regulations published under 40 CFR 355, *Emergency Planning and Notification* (EPA 1987a), and 40 CFR 370, *Hazardous Chemical Reporting: Community Right-To-Know* (EPA 1990b). These regulations establish the framework and responsibilities necessary for the development and implementation of applicable emergency response plans and the reporting requirements to provide persons with information regarding the hazardous properties of chemicals in their communities and places of work. The regulations published under 40 CFR 355.40 relate to emergency notification due to releases at a facility. The regulations in 40 CFR 370 concern the worker and community right-to-know. The requirements for this regulation are listed in 40 CFR 370, Subpart B. This includes 40 CFR 370.20 - 370.28.

10.2.4 Resource Conservation and Recovery Act of 1976

The requirements of RCRA apply to the generation, transport, treatment, storage and disposal of hazardous materials. The reporting and notification requirements applicable to 100-K Area Fuel Storage Basins and Engineering Laboratory under RCRA are those requirements applicable to generators of hazardous substances. These requirements can be found in 40 CFR 262.41-262.43 (EPA 1987c). This act provides the states with authority to regulate hazardous substances. The State of Washington has promulgated additional regulations regarding these substances under WAC 173-303, *Dangerous Waste Regulations* (WAC 1989).

The specific requirements of this section include the submission of biennial reports, exception reports, and any additional reports required by EPA upon their direction. Biennial reports must be submitted to the EPA regional administrator by March 1 of each even numbered year. Exception reports must be submitted to the EPA regional administrator within 35 d of the date the waste was accepted by the initial transporter.

10.3 WASHINGTON STATE/LOCAL REGULATIONS

10.3.1 WAC 173-303, Dangerous Waste Regulations

In WAC 173-303, the State of Washington declared regulations to designate, oversee, and establish programs to control the production, use, and disposal of DW, HW and EHW within the state (WAC 1989). These regulations are designed to protect the public health and the environment, and encourage recycling and related processes. The sections of this chapter which are applicable to 100-K Area Fuel Storage Basins and Engineering Laboratory are those sections dealing with requirements applicable to generators of DW. These sections include WAC 173-303-060 and WAC 173-303-070 through 173-303-230. The specific sections requiring notifications or reports are WAC 173-303-060, Notification and identification numbers, and WAC 173-303-220.

The specific requirements of this chapter include the following:

- Notification identification numbers - This includes notification to the state of the intent to generate, transport, offer for transport, transfer a DW, or own or operate a DW treatment, storage, disposal facility
- Generator Reporting - This includes annual reports and exception reports.

11.0 INTERFACE WITH THE OPERATIONAL ENVIRONMENTAL SURVEILLANCE PROGRAM

11.1 DESCRIPTION

The sitewide environmental monitoring plan, as described in the FEMP Management Plan (WHC 1991e), consists of two distinct but related components: environmental surveillance conducted by PNL and effluent monitoring conducted by Westinghouse Hanford. The responsibilities for these two portions of the EMP are delineated in a Memorandum of Understanding (PNL 1989). Environmental surveillance, conducted by PNL, consists of surveillance of all environmental parameters to demonstrate compliance with regulations. Effluent monitoring includes both in-line and facility effluent monitoring as well as near-field (near-facility) operational environmental monitoring. Projected EDEs, reported in this FEMP, are the products of in-line effluent monitoring. Near-field monitoring is required by Part O, "Environmental Monitoring," *Environmental Compliance Manual*, WHC-CM-7-5 (WHC 1991a), and procedures are described in *Operational Environmental Monitoring*, WHC-CM-7-4 (WHC 1988b).

11.2 PURPOSE

The purpose of near-field (operational environmental) monitoring is to determine the effectiveness of environmental controls in preventing unplanned spread of contamination from facilities and sites operated by Westinghouse Hanford for DOE. Effluent monitoring and reporting, monitoring of surplus and waste management units, and monitoring near-field environmental media are, therefore, conducted by Westinghouse Hanford for the purposes of: controlling operations, determining the effectiveness of facility effluent controls, measuring the adequacy of containment at waste transportation and disposal units, detecting and monitoring upset conditions, and evaluating and upgrading effluent monitoring capabilities.

11.3 BASIS

Near-field environmental surveillance is conducted to (1) monitor employee protection; (2) monitor environmental protection; and (3) ensure compliance with local, state, and federal regulations. Compliance with parts of DOE Orders 5400.1, *General Environmental Protection Program* (DOE 1988a); 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1990b); 5484.1, *Protection, Safety, and Health Protection Information Reporting System* (DOE 1983); 5820.2A, *Radioactive Waste Management* (DOE 1988b); and DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991), are addressed through this activity.

11.4 MEDIA SAMPLED AND ANALYSES PERFORMED

Procedure protocols for sampling, analysis, data handling, and reporting are specified in WHC-CM-7-4. Media include ambient air, surface water, groundwater, external radiation dose, soil, sediment, vegetation, and animals at or near active and inactive facilities and/or waste sites. Parameters monitored include the following, as needed: pH, water temperature, radionuclides, radiation exposure, and hazardous constituents. Animals that are not contaminated, as determined by a field instrument survey, are released at the capture location.

11.5 LOCATIONS

Samples are collected from known or suspected effluent pathways (e.g., downwind of potential releases, liquid streams, or proximal to release points). To avoid duplication, Westinghouse Hanford relies upon existing sample locations where PNL has previously established sample sites (e.g., air samplers in the 300 Area). There are 38 air samplers (4 in the 100 Area and 34 in the 200/600 Areas), 35 surface water sample sites (22 in the 100 Area and 13 in the 200/600 Areas), 110 groundwater monitoring wells (20 in the 100 Area, 89 in the 200/600 Areas, and 1 in the 300/400 Areas), 299 external radiation monitor points (182 survey points and 41 thermoluminescent dosimeter (TLD) sites in the 100 Area, 61 TLD sites in the 200/600 Areas, and 15 TLD sites in the 300/400 Areas), 157 soil sample sites (32 in the 100 Area, 110 in the 200/600 Areas, and 15 in the 300/400 Areas), and 95 vegetation sample sites (40 in the 100 Area, 40 in the 200/600 Areas, and 15 in the 300/400 Areas). Animal samples are collected at or near facilities and/or waste sites. Specific locations of sample sites are found in WHC-CM-7-4.

Additionally, surveys to detect surface radiological contamination, scheduled in WHC-CM-7-4, are conducted near and on liquid waste disposal sites (e.g., cribs, trenches, drains, retention basin perimeters, pond perimeters, and ditch banks), solid waste disposal sites (e.g., burial grounds and trenches), unplanned release sites, tank farm perimeters, stabilized waste disposal sites, roads, and firebreaks in the Operations Areas. There are 391 sites in the Operations Areas (100 in the 100 Area, 273 in the 200/600 Areas, and 18 in the 300/400 Areas) where radiological surveys are conducted.

11.6 PROGRAM REVIEW

The near-field (operational environmental) monitoring program will be reviewed at least annually to determine that the appropriate effluents are being monitored and that the monitor locations are in position to best determine potential releases.

11.7 SAMPLER DESIGN

Sampler design (e.g., air monitors) will be reviewed at least biannually to determine equipment efficiency and compliance with current EPA and industry [e.g., ANSI and ASTM] standards.

11.8 COMMUNICATION

The Operations and Engineering Contractor and the Research and Development Contractor will compare and communicate results of their respective monitoring programs at least quarterly and as soon as possible under upset conditions.

11.9 REPORTS

Results of the near-field operational environmental monitoring program are published in the document series WHC-EP-0145, *Westinghouse Hanford Company Environmental Surveillance Annual Report* (WHC 1988c). The radionuclide values in these reports are expressed in curies, or portions thereof, for each radionuclide per unit weight of sample (e.g., picocuries per gram) or in field instrument values (e.g., counts per minute) rather than EDE, which is calculated as the summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor.

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12.0 QUALITY ASSURANCE

This section provides the 100-K Area Fuel Storage Basins and Engineering Laboratory QA requirements for organizational structure, functional responsibilities, levels of authority, interfaces, and lines of communication for activities affecting the quality of work to meet the requirements for the FEMP. The K FEMP also follows the Hanford Site QAPP (WHC 1991d). The 100-K Area FEMP QA is based on the requirements of the EPA guidelines contained in EPA QAMS 005/80, *Interim Guidelines and Specifications for Preparing, Quality Assurance Project Plans (QAPP)* (EPA 1983), and the ANSI/ASME NQA-1, *Quality Assurance Program Requirement for Nuclear Facilities* (ANSI/ASME 1986). The Westinghouse QA Manual delineates the requirements of DOE Order 5700.6B (DOE 1986a) and RL Order 5700.1A (DOE-RL 1983). The *Quality Assurance Manual* forms the foundation of the QA program for Westinghouse Operations at the Hanford Site (WHC 1989d).

12.1 PROJECT DESCRIPTION

The general objective of the FEMP is to have written environmental monitoring plans for each site, facility, or process that uses, generates, releases, or manages significant pollutant or hazardous materials. Monitoring is performed to evaluate the effectiveness of effluent treatment and control for radioactive material inventory purposes, and to determine compliance with all DOE, EPA, state and local requirements pertaining to effluent and pollutant releases to the environment. Monitoring is conducted in a manner that provides accurate measurements of liquid and airborne pollutants in effluents as a basis for the following:

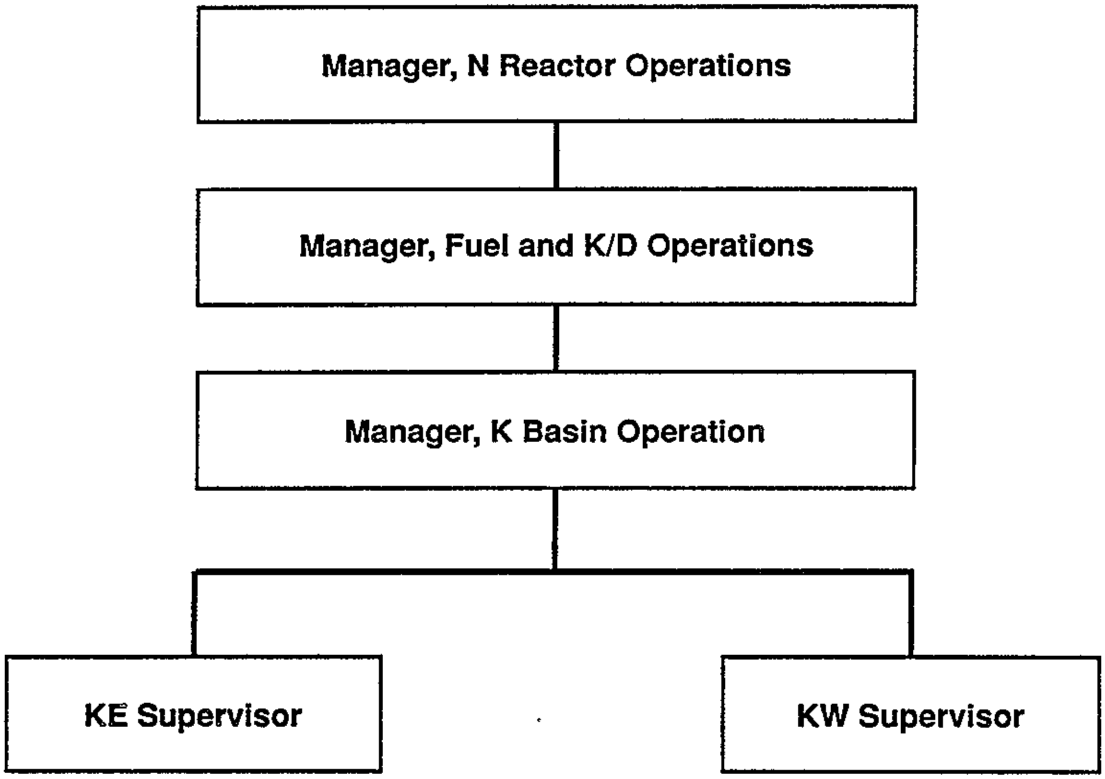
1. Determining compliance with applicable discharge and effluent control limits, including administrative limits designed to ensure compliance with fuel basin operating limits and effluent requirements
2. Evaluating the adequacy and effectiveness of effluent controls, and the efforts of achieving levels of radioactivity that are ALARA
3. Compiling an annual inventory of the radioactive material released in effluent and onsite discharges.

12.2 PROJECT ORGANIZATION AND RESPONSIBILITIES

12.2.1 Project Management

The responsibility for preparing, implementing, and maintaining an effluent monitoring program resides with each facility manager. At 100-K Area, this is accomplished through the following 100-K Area organizational assignments:

Figure 12-1. 100-K Basin Organizational Chart.



12.2.1.1 Operations Assessments/Environmental Safety.

1. Prepare the FEMP.

2. Ensure the FEMP is revised as process or regulatory changes occur and undergoes a formal review by June 1 of each yr and is updated every 3 yr.

3. Ensure that airborne and liquid effluents and releases comply with the FEMP requirements.

4. Ensure that the QC program (including periodic tests and measurements as required by this FEMP) is conducted at the required frequency.

5. Review the FEMP.

6. Review analytical results and investigate those in excess of applicable limits.

7. Approve effluent monitoring reports.

8. Ensure that the periodic tests and measurements required by this FEMP are conducted at the required frequency.

9. Ensure that the continuous emissions monitoring systems required by the provisions of this FEMP are maintained as required.

10. Identify the training requirements for their personnel to support requirements of the FEMP.

12.2.1.2 Operations/Hazardous and Radiological Waste.

1. Calibrations, maintenance, and repair records for all continuous monitoring instruments required in the FEMP.

2. Data and time identifying each period that the FEMP monitoring equipment is out of service.

3. Reorder checks and applicable logs.

4. Notify Environmental Protection of violations of ECL set by the FEMP.

5. Prepare written instructions to carry out the FEMP requirements.

6. Ensure that a copy of the complete chain-of-custody documentation is received with the laboratory sample data package.

7. Ensure that the continuous emission monitoring systems (CEMS) required by the provisions of this FEMP are maintained as required.

8. Collect and deliver effluent samples for analysis.

9. Ensure the sample is properly packaged, shipped and accompanied by the appropriate chain-of-custody form.

10. Identify training requirements, arrange training, and submit the FEMP training records for personnel to Centralized Training Records, according to WHC-CM-1-3, MRP 6.4 (WHC 1989b).

11. Establish and maintain chain-of-custody records for effluent monitoring samples.

12. Review analytical results and investigate those in excess of applicable limits.

13. Properly package all FEMP samples generated at N Reactor for shipment to laboratory for analysis.

14. Ensure that the sample is accompanied with sample collector's name, sample description, sample quantity, etc.

15. Prepare a statement of work describing laboratory services required and then secure laboratory services.

16. Provide data validation including the review of shipping information, chain-of-custody forms, holding time, calibration, QC and analytic identification and quantification.

17. Provide laboratory results to the FEMP coordinator.

18. After data validation, enter the analytical laboratory data into Hanford Environmental Information System (HEIS) computer database.

19. Ensure that analytical results are accurate.

12.2.1.3 Engineering.

1. Approve the purchase or modification specifications for effluent sampling or monitoring equipment.

2. Ensure that the CEMS required by the provisions of this FEMP are maintained as required.

3. Notify Regulatory Analysis of proposed construction of any new services of airborne emissions.

12.2.1.4 100 Area Environmental Protection.

1. Review the FEMP.

2. Review analytical results and investigate those in excess of applicable limits.

3. Review the FEMP annually by June 1 of each yr.

4. Have primary authority for the enforcement of the FEMP.

5. Evaluate the reporting requirements concerning data.

6. Perform surveillances to ensure that the periodic tests and measurements required by this FEMP are conducted at the required frequency.

7. Perform surveillances to ensure that airborne emissions and releases comply with the requirements of the FEMP.

8. Identify training requirements for Environmental Protection personnel to support the FEMP.

12.2.1.5 100 Area Facilities Health & Safety.

1. Protect N Reactor workers from radionuclides and other dangerous substances in the environment.

2. Perform periodic inspections of stack sampling and monitoring equipment by Health Physics.

12.2.1.6 N Reactor Quality Assurance.

1. Approve the purchase or modification specifications for effluent sampling or monitoring equipment.

2. Review the FEMP.

3. Perform periodic surveillances to ensure that airborne and liquid effluent monitoring comply with the requirements of the FEMP.

4. Identify training requirements for QA personnel to support requirements of the FEMP.

12.2.1.7 Facility Operations, Operational Maintenance Support; N Reactor Maintenance.

1. Ensure that the sampling systems required by the provisions of this FEMP are maintained and calibrated periodically.

2. Identify training requirement for maintenance personnel to support requirement of the FEMP.

12.2.2 Supporting Organizations

Routine technical support to the N Reactor Operations manager will be provided by several Westinghouse Hanford organizations. The supporting groups include Environment, Safety, Health, and the QA Division.

The OSM provides data validation services and participates in the evaluation and selection of analytical laboratory subcontractors. The Westinghouse Hanford OSM shall:

1. Transmit the laboratory sample data package, including original chain-of-custody documentation, to the N Reactor Operations manager

2. Prepare a statement of work describing laboratory services required and then secure the laboratory services

3. Provide data validation which will include review of shipping information, chain-of-custody forms, holding time, calibration, QC and analytic identification and quantification

4. Provide laboratory results to the FEMP coordinator

5. Be responsible for entering analytical laboratory data into the HEIS computer data base after data validation.

12.2.3 Analytical Laboratories

Analytical samples shall be shipped to a Westinghouse Hanford laboratory or an approved contractor for chemical and/or radiological analysis. For contractors, the applicable quality requirements shall be part of the approved work order or procurement document established by the OSM. Laboratories shall submit to OSM their analytical methods and QAPP for Westinghouse Hanford review and approval prior to use by the N Reactor Operations manager. At the direction of the N Reactor Operations manager, the services of alternate analytical chemical laboratories may be procured for split (performance audit) sample analysis.

12.2.4 Other Support Contractors

Procurement of services of other subcontractors to support any or all of the activities addressed in this FEMP may be initiated at the direction of the N Reactor Operations manager. Such services shall be in compliance with standard Westinghouse Hanford procedures.

12.3 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

The QA objectives for measurement applicable to the FEMPs primarily relate to: (1) the methods for chemical analysis; (2) the detection limits and analytical precision and accuracy appropriate for the effluent monitoring at 100-K; and (3) obtaining representativeness, complete, and reproducible effluent monitoring points. These objectives are provided for by the standard methods or agency approved procedures in Tables 9-1 through 9-5.

12.3.1 Analytical Methods

Tables 9-1 through 9-5 identify the analyses of interest and corresponding analytical reference methods. The list of analyses is developed from effluents being emitted by 100-K from 1981 to 1989. Appropriate analytical methods are selected from those provided in the EPA document titled *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, SW-846 (EPA 1986). Remaining analyses specify standard methods selected from appropriate EPA guidance documents or appropriate Westinghouse Hanford analytical procedures. Where options have been suggested or implied, the more reliable methods have been selected.

12.3.2 Limits for Analytical Precision and Accuracy

The performance of the analytical laboratory or laboratories providing support to the FEMP monitoring program shall be subject to standard methods or agency approved procedures. In this version of the FEMP, these parameters are presented as target values. These values must be adjusted and/or confirmed by Westinghouse Hanford OSM and the proposed laboratory prior to final approval of associated subcontractors or work orders. These target values have been developed from historically achievable values based on those negotiated and approved in previous analytical subcontracts for similar analysis at the Hanford Site, or are proposed on the basis of the level of performance that may routinely be expected for the methods indicated. The target values must be confirmed and/or adjusted to mutually satisfactory values and approved by Westinghouse Hanford and the proposed analytical laboratory in the process of subcontract or work order negotiation. Once the values are established as contractual requirement, Table 9-1 through 9-5 and this section of the FEMP shall be revised accordingly by the N Reactor Operations manager.

12.3.3 Representativeness, Completeness, and Comparability

Goals for data representativeness are addressed qualitatively by the specification of monitoring locations and intervals established by this FEMP. Objectives for completeness for FEMP monitoring shall require that the requirements (established by contract or procedure) for precision and accuracy be at the 95% confidence interval. Failure to meet this criteria shall be documented in data summary reports and shall be considered in the validation process by OSM. Corrective action measures shall be initiated by OSM. Approved analytical procedures shall require the use of the reporting techniques and units consistent with the EPA reference methods or other approved procedures listed in the FEMP to facilitate the comparability of data sets in terms of precision and accuracy.

12.4 SAMPLING PROCEDURES

Sampling shall be performed using approved procedures. All effluent sampling performed in support of the FEMP shall be performed in a manner that provides representative measurements of the volume and concentration of airborne and liquid pollutants released to the environment.

12.4.1 Other Supporting Procedures

With the exception of the analytical chemistry procedures specified in Table 9-1 through 9-5, procedures to be used for direct support of FEMP monitoring activities are presented in Table 9-6, cross referenced to their source documents and the type of activities that they will typically support. Any additions or modifications to procedures listed here shall be addressed in the text of individual procedures.

12.5 SAMPLE CUSTODY

All samples obtained during the course of this FEMP monitoring effort shall be controlled by a chain-of-custody procedure. Laboratory chain-of-custody procedures shall be reviewed and approved by Westinghouse Hanford. After completion of analysis, residual materials shall be returned to N Reactor Hazardous and Radiological Waste Control. Chain-of-custody forms shall be initiated for returned residual samples as required by the approved procedures applicable within the participating laboratory. The chain-of-custody form shall include the following information:

- Sample Number
- Analysis requested
- Type of sample (air, water, NPDES, etc.)
- Sample method used (composite, grab or replicate)
- Location of sample taken
- Data type (permit, FEMP, etc.)
- Sample destination
- Requestors name, organization, and phone number

12.6 CALIBRATION PROCEDURES

Calibration of 100-K Area measuring and test equipment, whether in existing inventory or purchased for this FEMP, shall be controlled as required by WHC-CM-4-2, QR 12.0, "Control of Measuring and Test Equipment," QI 12.1, "Acquisition and Calibration of Portable Measuring and Test Equipment," and QI 12.2, "Measuring and Test Equipment Calibration by User" (WHC 1989d).

Calibration of 100-K Area participant contractor, or subcontractor laboratory analytical equipment shall be as defined by applicable standard methods (Table 9-1 through 9-5) and Westinghouse Hanford OSM approved analytical procedures and laboratory QAPP.

12.7 ANALYTICAL PROCEDURES

Analytical methods or procedures based on the reference methods identified in Tables 9-1 through 9-5 and Section 12.4 shall be selected or developed and approved prior to use in compliance with appropriate 100-K Area fuel procedures, work orders, and/or procurement control requirements.

12.8 DATA REDUCTION, VALIDATION AND REPORTING

12.8.1 Data Reduction and Data Package Preparation

Analytical laboratories shall be responsible for preparing a report summarizing the results of analysis and a detailed data package that includes information necessary to perform data validation to the extent indicated by the requirement set by OSM. Data reporting requirements and data package content shall comply with the appropriate requirements of EPA SW-846 and contractor statement of work. These requirements shall be defined in work order or procurement documentation, subject to Westinghouse Hanford review and approval. Figure 12-2 presents the data reduction, validation, review and reporting process in flow chart format.

12.8.2 Data Reduction

Data reduction includes computation of summary statistics and their standard errors, confidence intervals, test of analysis relative to the parameters met in EPA SW-846. The data generated at the site and/or in the laboratory will be used to satisfy the FEMP requirements. Standard procedures will be used for the equations and the typical calculations sequence which is followed to reduce the data to the acceptable format.

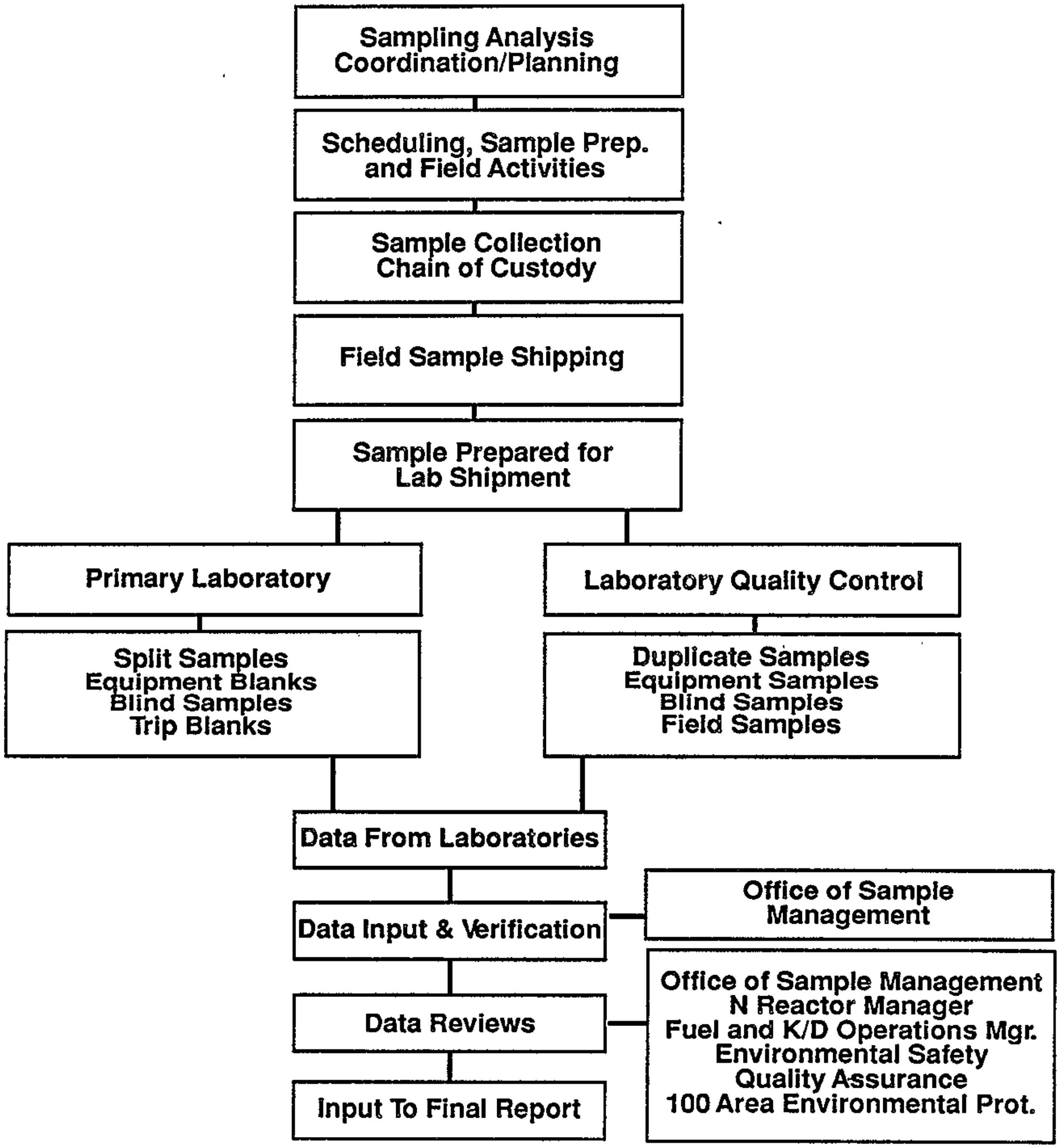
12.8.3 Background Data

Background data produced for internal records and not reported as part of the analytical data could include the following: laboratory worksheets, laboratory notebooks, sample tracking system forms, instrument logs, standards records, maintenance records, calibration records and associated QC records. These sources shall be available to inspect during audits, and to determine the validity of data. Location of such filed data will be determined by the N Reactor Operations manager. Data from other sources shall not be used in analysis or reports until the N Reactor Operations manager can be assured that the data was collected and analyzed according to the EPA SW-846 procedures and internal guidelines.

12.9 QUALITY CONTROL PROGRAM

FEMP samples shall be subject to in-process QC measures in both the field and laboratory. The quality control program at N Reactor is the responsibility of the N Reactor Operations manager. The quality control

Figure 12-2. Data Flow Scheme.



program in the laboratory is the responsibility of the laboratory manager. The QC program shall contain the following quality control elements:

Field Duplicate Samples--In each sampling period, a minimum of 5% of the total collected samples shall be duplicated, or one duplicate shall be collected for every 20 samples, whichever is greater. Duplicate samples shall be retrieved from the same sampling location using the same equipment and sampling technique, and shall be placed into two identically prepared and preserved containers.

Field duplicates shall be analyzed independently as an indication of gross errors in sampling techniques. The Hazardous and Radiological Waste Control supervisor will prepare the field duplicate sample bottles.

Split Samples--At the Hazardous and Radiological Waste Control supervisor's direction, field or field duplicate samples may be split in the field and sent to an alternate laboratory as a performance audit of the primary laboratory. Frequency shall be determined by the N Reactor Water Quality supervisor.

Blind Samples--At the Hazardous and Radiological Waste Control supervisors direction, blind reference samples may be introduced into any sampling round as a performance audit of the primary laboratory. Blind sample type shall be coordinated with the 222-S Laboratory.

Field Blanks--Field blanks consist of pure deionized distilled water, transferred into a sample container at the site and preserved with the reagent specified for the analytes of interest. Field blanks are used as a check on reagent and environmental contamination, and shall be collected at the same frequency as full duplicate samples.

Equipment Blanks--Equipment blanks consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures, and shall be collected at the same frequency as field duplicate samples.

Trip Blanks--Trip blanks consist of pure deionized distilled water added to one clear sample container, accompanying each batch of container shipped to the sampling activity. Trip blanks shall be returned unopened to the laboratory, and are prepared as a check on possible contamination originating from container preparation methods, shipment, handling, storage, or on site conditions. Requirements for trip blank preparation shall be included in procurement document of work orders to the sample container supplier and/or prepared in compliance with standard Westinghouse Hanford procurement procedures.

Matrix and Spike Duplicate Samples--Matrix spike and matrix spike duplicate samples require the addition of a known quantity of a representative analyte of interest to the sample to measure analytical accuracy. The spike and spike duplicate samples shall be created from replicates of a field sample. Replicate sample are separate aliquots removed from the same sample container in the laboratory. The selection of spike analytes, and concentrations shall be described in the laboratory QA program. One sample shall be spiked per sampling batch, or one every 20 samples, whichever is greater.

Quality Control Reference Samples--A QC reference sample shall be prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. Reference samples are required as an independent check on analytical techniques and methodology, and shall be run with every analytical batch, or every 20 samples, whichever is greater. Other requirements specific to laboratory analytical equipment calibration are included in Section 12.6. The minimum requirement of this section shall be included in procurement documents or work orders in compliance with standard Westinghouse Hanford procedures.

12.10 PREVENTATIVE MAINTENANCE

Measurement and testing equipment used in the field and laboratory that may affect the quality of the analytical data shall be subject to preventive maintenance that ensures minimal downtime. Field measuring equipment maintenance instructions shall be prepared and defined by the approved procedures governing such equipment. Laboratories shall be responsible for performing or managing the maintenance of items of analytical equipment. Maintenance requirements, spare part lists, and instructions shall be included in individual methods or in laboratory QA plans, subject to OSM Westinghouse Hanford review approval.

12.11 CORRECTIVE ACTION

Corrective action requests required as a result of surveillance or audit activity shall be documented and dispositioned as required by WHC-CM-4-2, QR 15.0, "Control of Nonconforming Item," QR 15.1, "Nonconforming Item Reporting," QR 16.0, "Corrective Action," QR 16.1, "Trending/Trend Analysis," and QR 16.2, "Corrective Action Reporting" (WHC 1989d). Primary responsibilities for nonconformance resolution and corrective action are assigned to the N Reactor Operations manager. Copies of all surveillance, nonconformance, audit, and corrective action documentation shall be forwarded to the FEMP QA records. The FEMP QA records location shall be specified by the N Reactor Operations manager.

12.12 QUALITY ASSURANCE REPORTS

Project activities shall be regularly assessed by surveillance and auditing processes. Surveillance, nonconformance, audit, and corrective action documentation shall be forwarded to the FEMP QA records on completion. The records location shall be specified by an N Reactor Operations manager. Records management requirements applicable to subcontractors or participant contractors shall be defined in the appropriate procurement documents or work orders.

13.0 INTERNAL AND EXTERNAL PLAN REVIEW

13.1 INTERNAL REVIEWS

After each revision, the FEMP will be reviewed by all affected organizations within the facility and approved by the manager of N Reactor Operations. These organizations and their responsibilities regarding the 100-K Area Fuel Storage Basins FEMP follow this procedure.

13.1.1 N Reactor Operations

The manager of N Reactor Operations is responsible for reviewing and approving the FEMP. This includes ensuring compliance of applicable operating procedures with the requirements set forth in the FEMP. Furthermore, this position is responsible for administrating the operational aspects of the FEMP and ensuring that reviews and updates to the plan are conducted.

13.1.2 N Reactor Environmental Safety

The manager of Environmental Safety is responsible for reviewing the FEMP and ensuring that all environmental safety aspects of the FEMP comply with federal and state regulations and company policy. This position is responsible for ensuring the FEMP is reviewed annually and updated every 3 yr.

13.1.3 Safety Technical Support

The manager of Safety Technical Support is responsible for reviewing the FEMP and ensuring that the FEMP requirements are reflected in Technical Specifications and Process Standards. This manager is responsible for ensuring that all procedural changes meet the requirements of the FEMP. This manager is also responsible for ensuring the FEMP is reviewed annually and updated every 3 yr.

13.1.4 100 Area Environmental Protection

The manager of 100 Area Environmental Protection is responsible for reviewing the FEMP to ensure adherence to company policies and requirements, as well as ensuring compliance with federal and state regulations.

13.1.5 North Facility Safety Assurance

The manager of North Facility Safety Assurance is responsible for reviewing the FEMP to ensure compliance with applicable company rules and federal and state regulations.

13.1.6 N Reactor Quality Assurance

The manager of N Reactor QA is responsible for reviewing the FEMP and performing periodic audits to ensure that all applicable QA requirements and guidelines are met.

13.2 EXTERNAL REVIEW

13.2.1 Department of Energy Field Office, Richland

The RL is responsible for reviewing and approving the FEMP to ensure that the plan complies with all applicable environmental protection laws, regulations and directives. The RL is responsible for overseeing, confirming and independently verifying FEMP contractor programs. In addition, the RL will perform FEMP related program appraisals.

14.0 COMPLIANCE ASSESSMENT

14.1 COMPARISON OF INSTRUMENT SPECIFICATIONS WITH REQUIRED STANDARDS

The standard that applies to the airborne effluent sampling program at 100-K Area is ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Material in Nuclear Facilities* (ANSI 1969). Based on the ANSI standard, the major considerations regarding proper sampling of airborne effluents at K Area are:

- Sample withdrawal point placement and sample entry tube design
- Sample particle sizes in regards to sample delivery line deposition and the need for isokinetic sampling
- Sampling frequency, duration, and sample volume rate
- Sample analysis detection/measurement sensitivity
- Sample component radioactive decay
- Sample operation/process frequency and duration.

Each of the currently active airborne effluent discharge points, which have the potential to release radioactive material, has been compared to the requirements of ANSI N13.1-1969. The results of these comparisons are given below.

14.1.1 105-KE and 105-KW Basins

The sample probes for the basin area exhaust consist of a single probe in each of the two exhausts above the basins. According to the ANSI standard, the exhausts size dictates multiple sample points in each exhaust. Isokinetic sampling cannot be ensured due to the lack of information on the sample heads in each duct. The sample lines from the basin areas do not meet the standard becuase they are too long and contain too many right angle bends. The sample lines from two vents are joined by a T. They then go to the sampler, a process which excessively increases turbulence. Each vent should have an individual sampler. Noble gases and H-3, which are major components of the fission product inventory in the fuel storage basins, are currently not being sampled in the effluent, and need to be addressed. The analyses performed are appropriate for the radionuclides in the sample and meet the standard. Only two of the four vents in each basin are sampled which is insufficient because up to 15,000 ft^3/min of airflow passes through these two nonsampled vents. All four vents should be sampled and ventilation flow measuring devices should be in place to accurately determine releases.

14.1.2 1706-KEL

The sample probe for the 1706-KEL is appropriate for the size of the stack and is located generally in accordance with the standard. The lack of instrumentation for determining total stack flow is a source of standard non-compliance. The prescribed sampling frequency and duration are appropriate to the standard criteria. The prescribed analyses are appropriate and meet the standard.

14.1.3 1706-KER

The sample probe location and configuration for the facility meet the general criteria of the standard. However, the lack of instrumentation for the stack discharge rate does not meet the standard for the sampling equipment. While the prescribed frequency of sampling is appropriate based on the standard, the exhaust system being sampled is not operational and therefore, the sample results are invalid. Another exhaust from the building is operational, but is not being sampled. Either the sampled exhaust should be made operational or the operational exhaust should be sampled.

14.2 COMPARISON OF INSTRUMENT SPECIFICATIONS WITH MONITORING CRITERIA

Other than sample filters and pumps which are appropriate, flow detection instrumentation is the only item in question. Stack flow is based on fan design rather than actual pre-measurement of the flow. This does not give accurate flow results and therefore, makes release results questionable.

14.2.1 Airborne Effluent Sampling Criteria

The DOE/EH-0173T (DOE 1991) criteria for airborne effluent sampling are contained in several parts of Section 3.0. The general criteria for monitoring/sampling radiological airborne effluent are as shown in Table 3-1. Additional criteria include:

- An inclusion in the FEMP of an assessment that determines the expected types and quantities of airborne emissions and establishes the monitoring/sampling needs
- Performance of the system sufficient for determination whether emissions are within DOE Order 5400.5 (DOE 1990b) limits
- Calibration of systems before use and recalibration any time they are subject to maintenance or modification that may affect the calibration. Recalibration of equipment at least annually and routine checks with known sources to determine proper functioning
- Provision for monitoring/sampling emissions during accident situations.

The criteria also include the following system design considerations:

- Timely, representative and adequately sensitive quantification of airborne emissions.
- Assurance that the system is qualified for the sampling task by:
  - Identification of actual or potential radionuclides present
  - Identification of background radionuclides
  - Presence of materials that could adversely affect the system
  - Internal and external conditions that could have deleterious effects on emission quantification
  - Process descriptions and variability
  - Particle size distribution
  - Cross-sectional homogeneity of radionuclide distribution at the sampling point.

14.2.2 Airborne Effluent Sampling System Evaluation

A comparison of the current airborne effluent sampling system with the DOE/EH-0173T criteria showed that none of the systems for the K Area meet the requirements because none of them have measuring devices to determine the flow of the vent system they monitor.

14.2.3 Liquid Effluent Sampling Criteria

The criteria for sampling of liquid effluents in DOE/EH-0173T dictate consideration of the following:

- Location of the sampling system
- Use of sample pumps where it is necessary to provide a uniform, continuous flow
- A redundant sampling system or one of the following:
  - A substitute sample transport system
  - The capability to shut the system down for fast repair
  - An alternate system for estimating releases if the system is not operating.
- Location of sample lines such as to allow for complete effluent mixing and sample port design to ensure proportionate sampling

- Capability to determine effluent stream and sample line flows with an accuracy of ± 10%
- System design to minimize deformation and sedimentation and prevent freezing of sample lines.

14.2.4 Liquid Effluent Sampling System Evaluation

A comparison of the liquid effluent sampling systems with the DOE/EH-0173T criteria showed that it meets the requirements.

14.3 COMPARISON OF INSTRUMENT SPECIFICATIONS WITH EFFLUENT CHARACTERISTICS

The current effluent sampling system is appropriate for the type of effluents present. Although the individual systems do not in all cases meet the standards, the grab sample analyses of liquid effluents and the analyses of particulate filters from the airborne effluent are appropriate for the anticipated radiological contaminants.

14.4 COMPARISON OF PROJECTED EFFLUENT CHARACTERISTICS WITH HISTORICAL DATA

Based on current projection of the status of K Area, the effluents should exhibit the same characteristics as those of 1989. The only changes anticipated in the effluents are possible reductions in levels of some radionuclides due to the lack of sources of further input into the systems.

14.5 COMPARISON OF EFFLUENT MONITORING CAPABILITIES WITH REGULATORY AND CONTRACTOR REQUIREMENTS

The effluent monitoring/sampling systems at 100-K Area were compared to the following regulatory documents:

- 40 CFR 61, Subpart H
- 40 CFR 61, Appendix B, Method 114
- DOE Order 5400.1
- DOE/EH-0173T
- WAC 173-480-070.

An assessment was made to verify that the 100-K Area FEMP complies with the Hanford Site QAPP.

Detailed results of these comparisons along with the document's specific requirements are contained in Section 16.4. A summary of the major areas of noncompliance with the requirements is provided below.

The comparison of the current capabilities with the requirements of 40 CFR 61, Subpart H (EPA 1989c) found deficiencies in the measurement of stack and vent emission rates; the lack of a QA program that conforms to the Section 16.5, Method 114 requirements; and the lack of all required information in the Annual Effluent Report. The 40 CFR 61, Appendix B, Method 114 comparison identified additional deficiencies in the QA requirement as well as in the lack of documentation of organizational structure, functions and authority. It also identified a lack of appropriate administrative controls for ensuring prompt response to rising levels of emissions. The lack of adequate calibration and sample tracking systems were also noted as program deficiencies, as were the lack of periodic reports to management on program performance.

The comparison with the requirements of DOE Order 5400.1 identified areas of noncompliance in regards to the annual Site Environmental Report, environmental monitoring general compliance, radiological monitoring and QA and data verification.

The comparison with the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991) resulted in the most specific deficiencies noted in any of the comparisons. The deficiencies included the lack of adequate system calibrations, the lack of an appropriate QA program for the sampling/monitoring activities, and the lack of timeliness in obtaining sample analysis results.

The comparison of the systems with the requirements of WAC 173-480-070 (WAC 1986a) showed that all of the specific applicable requirements were met.

14.6 EXEMPTIONS

There are no exemptions to the standards nor are any anticipated.

14.7 SYSTEM UPGRADES REQUIRED FOR COMPLIANCE

Based on the review of the current effluent sampling systems performed in the preceding sections, several upgrades are necessary to bring the systems into compliance with the various requirements. The following statements suggest needed improvements for the systems and recommend the priority for their implementation.

- The liquid effluent sampling systems need no upgrades
- In regards to the airborne effluent sampling system, the following upgrades are needed and should be implemented on a Priority 1 basis.
  - 105-KE and 105-KW Basins: Isokinetic sample probes with multiple sample points should be ensured. All four vents in each facility should have separate sampling systems. These systems should have short sampling tubes with minimal bends. Devices should be installed to assess total ventilation flow on each vent. In addition to particulate samples, H-3 and noble gases should also be sampled

- 1706-KEL: A device should be installed to assess total stack flow

- 1706-KER: A device should be installed to assess total stack flow. The exhaust system being sample should be operational.

15.0 SUMMARY AND CONCLUSIONS

15.1 AIRBORNE EFFLUENT RELEASE POINT CONCLUSION

The 100-K Area Fuel Storage Basin and Engineering Laboratory FEMP includes a sampling plan to collect particulate air samples from the four airborne release locations to measure radioactive releases. This is in order to measure the quantities released and assess their impacts on the public and the environment. The airborne release points are identified in Table 9-1.

The frequency of sampling the airborne effluent release points is based on the radiation dose to the maximum individual offsite. As the estimated maximum dose offsite declines with respect to the specific airborne effluent release point, the airborne sampling frequency declines from weekly, to monthly, to quarterly.

The air particulate samples are analyzed for gross alpha, gross beta, gamma scan, and the pure beta emitter, ^{90}Sr, and for plutonium. This analysis scheme is designed to detect the radionuclides that have the potential for being emitted from 105-KW and 105-KE fuel storage basins and from 1706-KEL and 1706-KER.

The current airborne effluent monitoring program does not meet the full intent of 40 CFR 61 (EPA 1989c) for hazardous air pollutants. The current program does not meet the requirements of Appendix B, Method 114 and Reference Methods 2, and 2a of Appendix A. The compliance assessment of this plan, as shown in Section 14.0, recommends upgrading the current air sampling program to be in full compliance with the regulations.

The current airborne effluent monitoring program does not fully meet DOE Orders 5400.1 (DOE 1988a) and 5400.5 (DOE 1990b). The Annual Site Environmental Report was not completed to comply with the June 1, 1991 deadline, the program does not meet 40 CFR 61 and the program does not have a QA program that fully meets the requirements of Appendix B, Method 114. In addition, the current effluent monitoring program does not meet the full intent of the *Environmental Regulatory Guide for Radiological Effluent Monitoring* (DOE 1991).

15.2 LIQUID EFFLUENT RELEASE POINT CONCLUSIONS

The liquid effluents from 1908-KE and 181-KE are monitored as outlined in the K Area FEMP, Table 9-2, to collect composite and grab samples for monitoring the effluents to the Columbia River in order to demonstrate compliance with DOE Orders, EPA and the state of Washington regulations. The K FEMP will comply with the requirements of the Hanford Site QAPP (WHC 1991d).

The frequency of sampling the liquid effluents is identified is Table 9-2, and varies from weekly, to monthly, to quarterly, as required by the NPDES permit (EPA 1981) and DOE orders.

The liquid effluent samples are analyzed for radioactivity and NPDES permit requirements. A complete listing of the analyses and their requirements is given in Tables 9-2, 9-3, 9-4, and 9-5.

The current liquid effluent sampling program meets the requirements of DOE Orders 5400.1, 5400.5, and the *Environmental Regulatory Guide for Radiological Effluent Monitoring.*

15.3 COMPLIANCE ASSESSMENT

The compliance assessment for the 100-K Area Fuel Storage Basins and Engineering Laboratory shows the current airborne effluent monitoring does not meet DOE orders, EPA regulations or state of Washington regulations. Section 14.5 and Section 16.4 identify the shortcomings of program and identify the corrective actions necessary to meet the requirements.

15.4 RECOMMENDATIONS

It is recommended that the 100-K Area FEMP be upgraded to meet the requirements of DOE, EPA and the state of Washington. It is also recommended the 100-K Area Fuel Storage Basins and Engineering Laboratory FEMP be updated when the facility complies with DOE, EPA and the state of Washington requirements.

16.0 ATTACHMENTS

16.1 REFERENCES

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16.2 TABLES

The following tables, 16-1 through 16-6, are a compilation of DOE, EPA, and WAC requirements and remarks that pertain to the K Basins FEMP.

Table 16-1. DOE ORDER 5400.1 (6 Sheets)

Section	DOE Order 5400.1 Requirement	YES	NO	Remarks
Chapter 2 Sec. 4c	ANNUAL SITE ENVIRONMENTAL REPORT. All DOE facilities that conduct significant environmental protection programs shall prepare an Annual Site Environmental Report. Environmental reports covering the previous calendar year shall be prepared annually and distributed by June 1 to EH-1 (10 copies), appropriate PSOs, the Office of Scientific and Technical Information (OSTI), the EPA, and to other agencies and organizations, as appropriate.		No	Annual site environmental reports are not submitted to EH-1 by June 1. However, effluent and environmental reports have been completed later in the year.
Chapter 2 Sec. 5A	REPORTS ON RADIOACTIVE EFFLUENT/ON-SITE DISCHARGE/UNPLANNED RELEASES. Radioactive Effluent and On-site Discharge Data Reports covering the previous calendar year shall be submitted to the Waste Information Systems Branch, EG&G Idaho, Inc., (EG&G) Idaho Falls, Idaho 83415, by April 1; a copy of the cover letter shall be sent to EH-1.	Yes		Radioactive effluent reports have been submitted to Waste Information Systems Branch, EG&G, by April 1.
Chapter 2 Sec. 5b	REPORTS ON RADIOACTIVE EFFLUENT/ON-SITE DISCHARGE/UNPLANNED RELEASES. Unplanned releases of radioactive materials in effluents, such as spills, leaks, etc., whether onsite or offsite, also shall be reported to the Information System Branch, EG&G, on Form DOE F 5821.1. This is in addition to meeting the occurrence reporting requirements of DOE 5000.3A.	Yes		Reports on radioactive effluents/on-site discharges/unplanned releases are submitted to Information System Branch, EG&G.

Table 16-1. DOE ORDER 5400.1 (6 Sheets)

Section	DOE Order 5400.1 Requirement	YES	NO	Remarks
Chapter 4 Sec. 4	ENVIRONMENTAL MONITORING PLANS. A written environmental monitoring plan shall be prepared for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. The plan shall contain the rationale and design criteria for the monitoring program, extent and frequency of monitoring and measurements, procedures for laboratory analyses, quality assurance requirements, program implementation procedures, and direction for the preparation and disposition of reports. The plan shall be approved by the appropriate Head of Field Organization, or his or her designee. The plan shall be reviewed annually and updated as needed. The plan shall identify and discuss two major activities: (a) effluent monitoring and (b) environmental surveillance. The plan shall reflect the importance of monitoring as a critical element of an effective environmental protection program. The plan shall be reviewed annually and updated every 3 years.	Yes		Westinghouse Hanford currently has an effluent monitoring program that is described in WHC-CM-7-3 (WHC 1988a) *Effluent Monitoring Program for the 100 Areas*. This program will be replaced with the K FEMP being developed for implementation by November 9, 1991.
Chapter 4 Sec. 5a2a	ENVIRONMENTAL MONITORING - GENERAL REQUIREMENTS. Effluent monitoring shall comply with applicable regulations and shall be conducted to provide representative measurements of the quantities and concentrations of pollutants in liquid and airborne discharges, and solid wastes. <u>Monitoring Stations</u>. Effluents from on-site waste treatment or disposal systems shall be monitored in accordance with applicable regulations, Influents to on-site waste treatment or disposal systems should be monitored as needed.	Yes		The current effluent monitoring program does not comply fully with the current DOE and EPA regulations. The K FEMP currently being developed will meet the current/applicable regulations.

Table 16-1. DOE ORDER 5400.1 (6 Sheets)

Section	DOE Order 5400.1 Requirement	YES	NO	Remarks
Chapter 4 Sec. 5a2c&d	Sample Analysis. Standard analyses shall be used to analyze samples whenever such methods are required by regulatory programs. Exemptions due to analytical problems or for non-routine analyses may be employed after receiving approval from the appropriate regulatory agency. Monitoring Data Recordkeeping. Auditable records shall be established in accordance with the requirements of DOE 5700.6B.	Yes		Standard analysis is performed in accordance with Method 114 of 40 CFR Part 61 (EPA 1989c) on the effluent samples.
Chapter 4 Sec. b1	Environmental Surveillance. Environmental surveillance shall be conducted to monitor the effects, if any, of DOE activities on on-site and off-site environmental and natural resources. An environmental surveillance screening program shall be undertaken at DOE sites to determine the need for a permanent surveillance program. Environmental surveillance shall be designed to satisfy one or more of the following program objectives; (a) Verify compliance with applicable environmental laws and regulations; (b) Verify compliance with environmental commitments made in Environmental Impact Statements, Environmental Assessments, Safety Analysis Reports, or other official DOE documents; (e) Provide a continuing assessment of pollution abatement programs.	Yes		An environmental surveillance program is conducted by Westinghouse Hanford in the near field area adjacent to K Area and PNL provides the site environmental surveillance program.
Chapter 4 Sec. 7a	RADIOLOGICAL MONITORING. Airborne radiation and radioactive materials discharged from DOE facilities shall comply with the requirements of 40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants."		No	The current effluent monitoring program does not meet the requirements of 40 CFR Part 61 Subpart H. The K FEMP is being developed to meet the Subpart H requirements.

Table 16-1. DOE ORDER 5400.1 (6 Sheets)

Section	DOE Order 5400.1 Requirement	YES	NO	Remarks
Chapter 4 Sec. 8a1	NON-RADIOLOGICAL MONITORING. <u>Air Monitoring - Emissions</u>. Air emission monitoring shall be in accordance with the requirements of applicable Federal, State, and local regulations authorized by the *Clean Air Act of 1977* (42 U.S.C 7401, <u>et. seq.</u>). Section 118 of the act specifically addresses the control of airborne pollution from federal facilities. Design of air quality monitoring programs should be undertaken with a thorough understanding of the complex framework of air quality management.	Yes		The K Area facilities do not emit non-radiological hazardous air pollutants, nor does they emit air pollutants as defined by the CAA Section 118 and in EPA regulations in 40 CFR Part 60 (EPA 1990c). Air pollutants as defined by the CAA are no longer emitted from K Area with the exception of radionuclides.
Chapter 4 Sec. 8a2	NON-RADIOLOGICAL MONITORING. <u>Air Monitoring - Emissions</u>. Where applicable, DOE facilities shall comply with monitoring requirements discussed in 40 CFR Part 60, which includes monitoring of fossil fuel combustion sources and associated test methods.	NA		These requirements do not apply for K Area facilities.
Chapter 4 Sec. 8a3	NON-RADIOLOGICAL MONITORING. <u>Air Monitoring - Emissions</u>. Large permanent facilities or modification to such facilities may require a Prevention of Significant Deterioration (PSD) permit prior to construction. In addition to pre- and most post-operational emission testing, the permit process may require up to a year of meteorological and ambient air quality monitoring. Monitoring shall conform to the EPA PSD monitoring regulations (40 CFR Part 58) which contain siting, quality assurance, and accuracy requirements.	NA		PSD requirements do not apply to K Area Facilities which are in standby awaiting orders to shutdown.

Table 16-1. DOE ORDER 5400.1 (6 Sheets)

Section	DOE Order 5400.1 Requirement	YES	NO	Remarks
Chapter 4 Sec. 8c1	NON-RADIOLOGICAL MONITORING. Water Monitoring - Effluents. Under the authority of the *Clean Water Act or 1977* (33 U.S.C. 1251, et. seq.), EPA has promulgated regulations for monitoring liquid effluent discharges. In the National Pollutant Discharge Elimination System (NPDES) established by section 402, the EPA Administrator, or States with approved programs.	Yes		The liquid effluent from K Area facilities are being monitored as required by the NPDES permit (EPA 1981) and 40 CFR 302 (EPA 1989a) for hazardous waste.
Chapter 4 Sec. 10a	QUALITY ASSURANCE AND DATA VERIFICATION. Quality Assurance. A quality Assurance program consistent with DOE 5700.6B shall be established covering each element of environmental monitoring and surveillance programs commensurate with its nature and complexity. The quality assurance program shall include, but not be limited to, the following: 1. Organizational responsibility 2. Program design 3. Procedures 4. Field quality control 5. Laboratory quality control 6. Human factors 7. Recordkeeping 8. Chain-of-custody procedures 9. Audits 10. Performance reporting and 11. Independent data verification.		No	The current effluent monitoring program does not fully meet the elements of a QA program consistent with DOE 5700.6B (DOE 1986a). However, the K FEMP is being developed with the intent of meeting these requirements. There is currently no data verification by an independent group. The QAPP (WHC 1991d) that was developed for the Hanford Site will correct this deficiency.

Table 16-1. DOE ORDER 5400.1 (6 Sheets)

Section	DOE Order 5400.1 Requirement	YES	NO	Remarks
Chapter 4 Sec. 10c	QUALITY ASSURANCE AND DATA VERIFICATION. <u>DOE Laboratory Quality Assessment Program for Radioactive Material.</u> All DOE and contractor laboratories that conduct analytical work in support of DOE environmental radiological monitoring programs for radioactive materials shall participate in the DOE interlaboratory quality assurance program coordinated by the DOE Environmental Measurements Laboratory, New York, New York. Guidelines and procedures for this program shall be issued annually by EH-1.	Yes		The current N Reactor effluent monitoring program does participate in the DOE interlaboratory QA program coordinated by DOE Environmental Measurements Laboratory, NY, N.Y.. However, Westinghouse Hanford does participate in the QA program from Brookhaven National Labs and the Cincinnati Labs (Taft Engineering Labs)

EH-1 = Assistant Secretary for Environment, Safety and Health
PSO = Program Senior Official

Table 16-2. 40 CFR 61 Subpart H-National Emission Standards For Emissions of Radionuclides Other Than Radon From DOE Facilities. (6 Sheets)

Section	40 CFR 61 Subpart H Requirement	YES	NO	Remarks
61.93 Emission monitoring and test procedures	To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval.	Yes		A FEMP determination report has been completed for K Area facilities.
61.93(b)	Radionuclide emission rates from point sources (stacks or vents) shall be measured in accordance with the following requirements or other procedures for which EPA has granted prior approval: (1) Effluent flow rate measurements shall be made using the following methods: (i) Reference Method 2 of Appendix A to part 60 shall be used to determine velocity and volumetric flow rates for stacks and large vents. (ii) Reference Method 2A of Appendix A to part 60 shall be used to measure flow rates through pipes and small vents. (iii) The frequency of the flow rate measurements shall depend upon the variability of the effluent flow rate. For variable flow rates, continuous or frequent flow rate measurements shall be made. For relatively constant flow rates only periodic measurements are necessary.		No	The emission rates for stacks and vents at KE and KW basins and 1706-KER/KEL have not been measured in accordance with Method 2 of Appendix A to 40 CFR Part 60 (EPA 1990c) or Method 2A for pipes and small vents.

Table 16-2. 40 CFR 61 Subpart H-National Emission Standards For Emissions of Radionuclides Other Than Radon From DOE Facilities. (6 Sheets)

Section	40 CFR 61 Subpart H Requirement	YES	NO	Remarks
61.93(b)(2)	Radionuclides shall be directly monitored or extracted, collected and measured using the following methods: (i) Reference Method 1 of Appendix A Part 60 shall be used to select monitoring or sampling sites. (ii) The effluent stream shall be directly monitored continuously with an in-line detector or representative samples of the effluent stream shall be withdrawn continuously from the sampling site following the guidance presented in ANSI N13.1-1969 "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities" (including the guidance presented in Appendix A of ANSI N13.1) The requirements for continuous sampling are applicable to batch processes when the unit is in operation. Periodic sampling (grab samples) may be used only with EPAs prior approval. Such approval may be granted in cases where continuous sampling is not practical and radionuclides emission rates are relatively constant. In such cases, grab samples shall be collected with sufficient frequency so as to provide a representative sample of the emissions.	Yes		Radionuclides are measured by radioanalytical techniques that meet Method 1 of Appendix A Part 60 and the ANSI N13.1-1969 (ANSI 1969).

Table 16-2. 40 CFR 61 Subpart H-National Emissions Standards For Emissions of Radionuclides Other Than Radon From DOE Facilities. (6 Sheets)

Section	40 CFR 61 Subpart H Requirement	YES	NO	Remarks
61.93(b)(2)(iii)	Radionuclides shall be collected and measured using procedures based on the principles of measurement described in Appendix B, Method 114. Use of methods based on principles of measurement different from those described in Appendix B, Method 114 must have prior approval from the Administrator. EPA reserves the right to approve measurement procedures.	Yes		Radionuclides are collected and measured by analytical methods described in Appendix B, Method 114.
61.93(b)(2)(iv)	A quality assurance program shall be conducted that meets the performance requirements described in Appendix B, Method 114.		No	The current effluent monitoring program does not conform to the QA program in Appendix B, Method 114. The QAPP (WHC 1991d) that was developed for the Hanford Site will correct this deficiency.
61.93(b)(4)(i)	Radionuclides emission measurements in conformance with the requirements of paragraph (b) of this section shall be made at all release points which have a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent in excess of 1% of the standard. All radionuclides which could contribute greater than 10% of the potential effective dose equivalent for a release point shall be measured. With prior EPA approval, DOE may determine these emissions through alternative procedures.	Yes		Radionuclide emission measurements in conformance with paragraph (b) are made at the significant effluent release points that have a potential to release radionuclides. However, the measurements do not fully meet the intent or requirements of Subpart H.

Table 16-2. 40 CFR 61 Subpart H-National Emission Standards For Emissions of Radionuclides Other Than Radon From DOE Facilities. (6 Sheets)

Section	40 CFR 61 Subpart H Requirement	YES	NO	Remarks
61.93(b)(4)(ii)	To determine whether a release point is subject to the emission measurement requirements of paragraph (b) of this section, it is necessary to evaluate the potential for radionuclides emissions for that release point. In evaluation the potential of a release point to discharge radionuclides into the air for the purposes of this section, the estimated radionuclides release rates shall be based on the discharge of the effluent stream that would result if all pollution control equipment did not exist, but the facilities operations were otherwise normal.	Yes		The effluent release points were evaluated in the K FEMP determination. Based on the K FEMP determination a K FEMP has been developed to meet the requirements during standby.
61.93(b)(5)(v)	A quality assurance program shall be conducted that meets the performance requirements described in Appendix B, Method 114.		No	The current effluent monitoring program does not fully meet the requirements of Appendix B, Method 114. See Method 114 Compliance Assessment. The QAPP (WHC 1991d) that was developed for the Hanford Site will correct this deficiency.

Table 16-2. 40 CFR 61 Subpart H-National Emission Standards For Emissions of Radionuclides Other Than Radon From DOE Facilities. (6 Sheets)

Section	40 CFR 61 Subpart H Requirement	YES	NO	Remarks
61.94(b) Compliance and reporting	In addition to the requirements of paragraph (a) of this section, an annual report shall include the following information: (1) The name and location of the facility. (2) A list of the radioactive materials used at the facility. (3) A description of the handling and processing that the radioactive materials undergo at the facility. (4) A list of the stacks or vents or other points where radioactive materials are released to the atmosphere. (5) A description of the effluent controls that are used on each stack, vent, or other release point and an estimate of the efficiency of each control device. (6) Distances from the points of release to the nearest residence, school, business or office and the nearest farms producing vegetables, milk, and meat. (7) The values used for all other user supplied input parameters for the computer models (e.g. meteorological data) and the source of these data. (8) A brief description of all construction and modifications which were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived under 91.96 and associated documentation developed by DOE to support the waiver.		No	An annual effluent report is completed each year; however, the report does not contain all of the information required in 40 CFR 61.94 (b) (EPA 1989c).

Table 16-2. 40 CFR 61 Subpart H-National Emission Standards For Emissions of Radionuclides Other Than Radon From DOE Facilities. (6 Sheets)

Section	40 CFR 61 Subpart H Requirement	YES	NO	Remarks
61.94(c)	If the facility is not in compliance with the emission limits of 61.92 in the calendar year covered by the report, then the facility must commence reporting to the administrator on a monthly basis the information listed in paragraph (b) of this section, for the preceding month. These reports will start the month immediately following the submittal of the annual report for the year in noncompliance and will be due 30 days following the end of each month. This increased level of reporting will continue until the administrator has determined that the monthly reports are no longer necessary.	Yes		K Area facilities are is in compliance with the emission limits of 40 CFR 61.92 (EPA 1989c).
61.95 Recordkeeping requirements.	All facilities must maintain records documenting the source of input parameters including the results of all measurements upon which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine effective dose equivalent.	Yes		K Area maintains records and documents to support the premise that K Area meets the requirements.

Table 16-3. Test Method 114 For Measuring Radionuclide Emissions From Stationary Sources. (4 sheets)

Section	40 CFR 61 Test Method 114 Requirement	YES	NO	Remarks
4.0	Each facility required to measure their radionuclide emissions shall conduct a quality assurance program in conjunction with the radionuclide emission measurements. This program shall assure that the emission measurements are representative, and are of known precision and accuracy and shall include administrative controls to assure prompt response when emission measurements indicate unexpectedly large emissions. The program shall consist of a system of policies, organizational responsibilities, written procedures, data quality specifications, audits, corrective actions and reports. This quality assurance program shall include the following program elements:		No	The current effluent monitoring program does not fully meet the QA requirements in 40 CFR Part 61 Method 114 (EPA 1989c). The QAPP (WHC 1991d) developed for the Hanford Site will correct this deficiency.
4.1	The organizational structure, functional responsibilities, levels of authority and lines of communications for all activities related to the emissions measurements program shall be identified and documented.		No	The organizational structure functional responsibilities, and lines of communications are not documented or identified.
4.2	Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.		No	There are currently no administrative controls to ensure a prompt response to rising emission levels.
4.3	The sample collection and analysis procedures used in measuring the emissions shall be described including where applicable.	Yes		The collection and analysis is described for the current program in WHC-CM-7-3 (WHC 1988a).
4.3.1	Identification of sampling sites and number of sampling points, including the rationale for site selections.	Yes		The sampling sites and number of sampling points, including rationale are documented.

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Table 16-3. Test Method 114 For Measuring Radionuclide Emissions From Stationary Sources. (4 sheets)

Section	40 CFR 61 Test Method 114 Requirement	YES	NO	Remarks
4.3.2	A description of sampling probes and representativeness of the samples.	Yes		The representativeness of the samples is documented.
4.3.3	A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures and frequency of calibration.	Yes		There is a description of the sensitivity of the effluent monitoring program in WHC-CM-7-3 (WHC 1988a) and the recently developed K FEMP.
4.3.4	A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures and frequency of calibration.	Yes		There is a description of the sample collection systems in the K FEMP.
4.3.5	A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures and frequency of calibration.	Yes		The laboratory analysis procedures are documented by Westinghouse Hanford at the 222-S Laboratory.
4.3.6	A description of the sample flow rate measurement systems or procedures, including calibration procedures and frequency of calibration.		No	There are calibration procedures and frequency of calibration.
4.3.7	A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures and frequency of calibration.		No	No measurements of stack or vent flow rates exist.

Table 16-3. Test Method 114 For Measuring Radionuclide Emissions From Stationary Sources. (4 sheets)

Section	40 CFR 61 Test Method 114 Requirement	YES	NO	Remarks
4.4	The objectives of the QA program shall be documented and shall state the required precision, accuracy and completeness of the emission measurement data including a description of the procedures used to assess these parameters. Accuracy is the degree of agreement of a measurement with a true or known value. Precision is a measure of the agreement among individual measurements of the same parameters under similar conditions. Completeness is a measure of the amount of valid data obtained compared to the amount of expected under normal conditions.	Yes		The accuracy and precision of the effluent measurements is documented in the WHC-CM-7-3 (WHC 1988a) and the 222-S Laboratory Procedures. The QAPP (WHC 1991d) requires that the monitoring data be assessed by OSM and 100 Area Environmental Protection and consider the chain-of-custody and field transfer requirements.
4.5	A quality control program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include where applicable a system of replicates, spiked samples, split samples, blanks and control charts. The number and frequency of such quality control checks shall be identified.	Yes		There is a quality control program covering radionuclide analysis at the 222-S Laboratory.
4.6	A sample tracking system shall be established to provide for positive identification of samples during collection, storage and analysis.		No	There is currently no sample tracking system.
4.7	Periodic internal and external audits shall be performed to monitor compliance with the quality assurance program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.		No	There have been no periodic internal or external audits of the effluent monitoring system in the last 3 yr. The QAPP (WHC 1991d) developed for the Hanford Site will correct this deficiency.

Table 16-3. Test Method 114 For Measuring Radionuclide Emissions From Stationary Sources. (4 sheets)

Section	40 CFR 61 Test Method 114 Requirement	YES	NO	Remarks
4.8	A corrective action program shall be established including criteria for when corrective actions will be taken and who is responsible for taking the corrective action.		No	There is no corrective action program that has been utilized routinely for the effluent monitoring program. The QAPP (WHC 1991d) developed for the Hanford Site will correct this deficiency.
4.9	Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits and description of corrective actions.		No	There are no periodic reports to management concerning the effluent monitoring performance. The QAPP developed for the Hanford Site will correct this deficiency.
4.10	The quality assurance program should be documented in a quality assurance project plan which should address each of the above requirements.	Yes		The QA program is documented in the K FEMP. There is also a QAPP developed for the Hanford Site which will document the QA program.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
2a Liquid Effluent Monitoring	All liquid effluent streams should be evaluated and their potential for release of radioactive material assessed. Based on this assessment, decisions should be made regarding necessary effluent monitoring systems and the rationale should be documented in the Environmental Monitoring Plan.	Yes		The FEMP determination (WHC 1991b) examined and evaluated all liquid effluent streams for potential release of radioactive material and the results were used to determine necessary monitoring/sampling systems.
2b	Liquid effluents from DOE-controlled facilities that have the potential for radioactive contamination should be monitored in accordance with the requirements of DOE 5400.1 and DOE 5400.5.	Yes		The requirements for liquid effluent monitoring are met by the current sampling program and the FEMP required systems, and are also included within the QAPP (WHC 1991d) developed for the Hanford Site.
2c	Facility operators should provide monitoring of liquid waste streams adequate to 1) demonstrate compliance with the requirements of DOE 5400.5, Chapter II, paragraphs 1a, 1d, 2a, and 3, 2) quantify radionuclides released from each discharge point, and 3) alert affected process supervisors of accidents in processes and emission controls.	Yes		The sampling programs provide the data necessary to meet the compliance requirements, document releases and provide indications of off normal releases.
2d	When continuous monitoring or continuous sampling is provided, the overall accuracy of the results should be determined (±% accuracy and the % confidence level) and documented in the Environmental Monitoring Plan.	Yes		The FEMP documents the accuracy of the continuous sampling systems.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
2e	Provisions for monitoring of liquid effluents during an emergency should be considered when determining routine liquid effluent monitoring program needs.	Yes		The liquid effluent sampling points used were determined with consideration of emergency sampling needs.
2f	The selection or modification of a liquid effluent monitoring system should be based on a careful characterization of the sources(s), pollutant(s), (characteristics and quantities), sample-collection system(s), treatment system(s), and final release point(s) of the effluents.		No	The current review for needed modifications/improvements is covering these areas.
2g	For all new facilities or facilities that have been modified in a manner that could affect effluent release quantity or quality or that could affect the sensitivity of the monitoring or surveillance systems, a preoperational assessment should be made and documented in the Environmental Monitoring Plan to determine the types and quantities of liquid effluents to be expected from the facility and to establish the associated effluent monitoring needs of the facility.		No	The K FEMP assesses monitoring.
2h	The performance of the effluent monitoring systems should be sufficient for determining whether effluent releases of radioactive material are within the Derived Concentration Guides specified in DOE 5400.5 and comply with the reporting requirements of Chapter II, paragraph 7 of that order.	Yes		Current systems are adequate to determine releases relative to DCGs.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
2i	The required detection levels of the analysis and monitoring systems should be sufficient to demonstrate compliance with all regulatory requirements consistent with the characteristics of the radionuclides that are present or expected to be present in the effluent.	Yes		The analysis detection limits for samples taken are adequate to demonstrate regulatory compliance of releases.
2j	Sampling systems should be sufficient to collect representative samples that provide for an adequate record of releases from a facility, to predict trends, and to satisfy needs to quantify releases.	Yes		The systems used are adequate to collect representative samples of the effluents.
2k	Continuous monitoring and sampling systems should be calibrated before use and recalibrated any time they are subject to maintenance, modification, or system changes that may affect equipment calibration.		No	The continuous sampling systems in operation are not calibrated following maintenance or system modifications.
2l	Sampling and monitoring systems should be recalibrated at least annually and routinely checked with known sources to determine that they are consistently functioning properly.		No	The sampling systems are not calibrated routinely.
2m	Environmental conditions (e.g., temperature, humidity, radiation levels, dusts, and vapors) should be considered when locating effluent monitoring systems to avoid conditions that will influence the operation of the system.	Yes		Locations of sample points considered the appropriate environmental conditions.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
2n	Off-line liquid transport lines should be replaced if they become contaminated (to the point where the sensitivity of the system is affected) with radioactive materials or if they become ineffective in meeting the design basis within the established accuracy/confidence levels.	N/A		Sampling appropriate to the requirement is feasible.
2o	If continuous monitoring/sampling and recording of the effluent quantity (stream flow) is not feasible for a specific effluent stream, the extenuating circumstances should be documented in the Environmental Monitoring Plan.	N/A		Sampling appropriate to the requirement is feasible.
2p	Sampling/monitoring lines and components should be designed to be compatible with the chemical and biological nature of the liquid effluent.	Yes		The systems in use have lines that are compatible with the effluent and samples.
2q	The output signal instrumentation, monitoring system recorders, and alarms should be in a location that is continuously occupied by operations or security personnel.		No	No continuous monitor is on the system.
2r	To signal the need for corrective actions that may be necessary to prevent public or environmental exposures from exceeding the limits or recommendations given in DOE 5400.5, when continuous monitoring systems are required, they should have alarms set to provide timely warnings.	N/A		No continuous monitoring is performed.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
2s	As they apply to the monitoring/sampling of liquid effluents, the general quality assurance program provisions described in Chapter 10 of this guide should be followed.		No	There are no documented audits on documented data management procedures as required by 40 CFR 61, Method 114 (EPA 1989c).
3a Airborne Effluent Monitoring	All airborne emissions from each facility (DOE site) should be evaluated and their potential for release of radionuclides assessed. Based on its assessment, decisions should be made regarding necessary effluent monitoring systems and the rationale should be documented in the site Environmental Monitoring Plan. The potential for emissions should include consideration of the loss of emission controls while otherwise operating normally.	Yes		The FEMP determination (WHC 1991b) evaluated all airborne emissions and their potential for release of radioactive material. The FEMP also documents these evaluations.
3b	Airborne emissions from DOE-controlled facilities that have the potential for causing doses exceeding .1 mrem effective dose equivalent to a member of the public under realistic exposure conditions from emissions in a year should be monitored in accordance with the requirements of DOE 5400.1 and DOE 5400.5.	Yes		Currently none qualify.
3c	The criteria for monitoring listed in Chapter 3 of this guide should be used to establish the airborne emission monitoring programs for DOE-controlled sites.	Yes		The Environmental Regulatory Guide Chapter 3 criteria (DOE 1991) was used in developing the FEMP defined program.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
3d	For all new facilities or facilities that have been modified in a manner that could affect effluent release quantity, or quality or that could affect the sensitivity of monitoring or surveillance systems, a preoperational assessment should be made and documented in the site Environmental Monitoring Plan to determine the types and quantities of airborne emissions to be expected from the facility, and to establish the associated airborne emission monitoring needs of the facility.	N/A		
3e	The performance of the airborne emissions monitoring systems should be sufficient for determining whether the releases of radioactive materials are within the limits or requirements specified in DOE 5400.5.		No	Not for all samples. Questions of representative samples exist for some of the sample sites.
3f	Sampling and monitoring systems should be calibrated before use and recalibrated any time they are subject to maintenance or modification that may affect equipment calibration.		No	Not for current sampling systems. Vacuum pump flow and exhaust flow not given by calibrated instruments.
3g	Sampling and monitoring systems should be recalibrated at least annually and routinely checked with known sources to determine that they are consistently functioning properly.		No	Not calibrated.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
3h	Provisions for monitoring of airborne emissions during accident situations should be considered when determining routine airborne emission monitoring program needs.	Yes		Provisions for sampling airborne emissions in emergency situations were considered.
3i	Diffuse sources (i.e., area sources or multiple point sources in a limited area) should be identified and assessed for their potential to contribute to public dose and should be considered in designing the site emissions monitoring and environmental surveillance program. Diffuse sources that may contribute a significant fraction (e.g., 10%) of the dose to members of the public resulting from site operations should be identified, assessed, documented, and verified annually.	Yes		The FEMP determination (WHC 1991b) considered diffuse sources in the determination of required sample locations.
3j	Airborne emission sampling and monitoring systems should demonstrate that quantification of airborne emissions is timely, representative, and adequately sensitive.		No	Not timely when lab analysis takes weeks. Representative-not certain for system with long sample lines, no flow instrumentation, etc.
3k	To the extent practicable, samples should be extracted from the effluents from a location and in a manner that provides a representative sample, using multiport probes if necessary.		No	KE and KW Basins have single probes.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
3l	Where a significant potential (greater than once per year) exists for approaching or exceeding a large fraction of the emission standard (e.g., 20%), continuous monitoring should be required.	N/A		
3m	The design of radioiodine monitors will be such that replacement of sorbent and filter should not disturb the geometry between the collector and detectors.		No	No radioactive iodine monitoring required-standby.
3n	To signal the need for corrective actions that may be necessary to prevent public or environmental exposures exceeding the limits or recommendations given in DOE 5400.5, when continuous monitoring systems (as required by the criteria in Chapter 3) are required, they should have alarms set to provide timely warnings.		No	Potential does not exist.
3o	As they apply to the monitoring of airborne emissions, the general quality assurance program provisions of Chapter 10 of this guide should be followed.		No	There are no documented audits or data management procedures as required by 40 CFR 61, Method 114 (EPA 1989c).
6a Laboratory Procedures	Laboratory procedures and practices should be documented in the site Environmental Monitoring Plan.	Yes		FEMP references the 222-S/contract analysis procedures, as well as the QAPP (WHC 1991d) developed for the Hanford Site.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
6b	Each monitoring and surveillance organization should have a sample identification system that provides positive identification of samples and aliquots of samples throughout the analytical process. The system should incorporate a method for tracking all pertinent information obtained in the sampling process.	Yes		The samples are identified, labeled and entered into a log book. Chain-of-custody documentation is prepared and accompanies the samples.
6c	Each laboratory should establish and adhere to written procedures to minimize the possibility of cross-contamination between samples. High -activity samples should be kept separate from low-activity samples.	Yes		Laboratory procedures at 222-S establish cross contamination control and define requirements for handling samples based on activity.
6d	The integrity of samples should be maintained (i.e., minimize degradation of samples by using proper preservation and handling practices that are compatible with analytical methods).	Yes		222-S Laboratory procedures provide for proper handling and preservation of samples.
6e	Specific analytical methods should be identified, documented, and used to identify and quantify all radionuclides in the facility inventory or effluent that contribute 10% or more to the public dose or environmental contamination associated with the site.	Yes		The methods for analysis are documented in laboratory procedures, and in the QAPP (WHC 1991d) developed for the Hanford Site.
6f	Standard analytical methods should be used for radionuclide analyses (when available). Any modification of standard methods should be documented.	Yes		The methods prescribed by procedures are EPA or other standard analyses.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
6g	Methods, requirements, and necessary documentation should be specified in analytical contracts.	Yes		Westinghouse Hanford Contract with IT Labs contains such specifications. These are also included within the QAPP (WHC 1991d) developed for the Hanford Site.
6h	All sites that release or could release gamma-emitting radionuclides should have the capability (either in-house or outside) of having samples (routine, special, or emergency) analyzed by gamma-ray spectroscopy systems.	Yes		Gamma-ray spectroscopy is available when needed. The time to obtain the results, however ranges from 7 to 90 days.
6i	Counting equipment should be calibrated using, at a minimum, the calibration frequency recommendations of the manufacturers to obtain accurate results.	Yes		There are procedures in place that prescribe the calibrating requirements and frequency for the equipment used for analyses.
6j	Check sources should be counted periodically on all counters to verify that the counters are giving correct results.	Yes		Procedures for QC prescribe check source counting requirements.
6k	Samples that are sent offsite for analysis or for laboratory intercomparison should be monitored for contamination and radiation levels and should be packaged in a manner that meets applicable transportation regulations and requirements.	Yes		Offsite Transport Requirements dictate procedures to be followed.
6l	As they apply to laboratory procedures, the general quality assurance program provisions of Chapter 10 of this guide should be followed.	Yes		QA and QC are provided through audits and appraisals of laboratory and performance.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
7a Data Analysis and Statistical Treatment	The statistical techniques used to support the concentration estimates, determine their corresponding measures of reliability, and to compare radionuclide data between sampling and/or measurement points and times should be designed with consideration of the characteristics of effluent and environmental data.	Yes		The statistical techniques used are designed with the effluent characteristics and environmental data as considerations.
7b	Documented and approved sampling, samplehandling, analysis, and data management techniques should be used to reduce the variability of results.		No	Currently such procedures are not documented. They are included within the QAPP (WHC 1991d) developed for the Hanford Site.
7c	The level of confidence in the data due to the radiological analyses should be estimated by analyzing blanks and spiked pseudosamples and by comparing the resulting concentration estimates to the known concentrations in those samples.	Yes		Laboratory analyses include analysis of blanks and of spiked samples for QC.
7d	The precision of radionuclide analytical results should be reported as a range, a variance, a standard deviation, a standard error, and/or a confidence interval.	Yes		Analytical results of radionuclides are reported with identified error data.
7e	Data should be examined and entered into the data base promptly after analysis.	Yes		Data received is routinely reviewed and incorporated into the data base.

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Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
7f	Outliers should be excluded from the data only after investigation confirms that an error has been made in the sample collection, preparation, measurement, or data analysis process. As each data point is collected, it should be compared to previous data, because such comparison can help identify unusual measurements that require investigation or further statistical evaluation.	Yes		Procedures define the investigation requirements and process to be followed prior to exclusion of outlying data points.
7g	As they apply to data analysis and statistical treatment activities, the general quality assurance program provisions of Chapter 10 of this guide should be followed.		No	Audits of the program have not been performed.
8a Dose Calculations	Except where mandated otherwise (e.g., compliance with 40 CFR Part 61), the assessment models selected for all environmental dose assessments should appropriately characterize the physical and environmental situation encountered. The information used in dose assessments should be as accurate and realistic as possible.	Yes		The dose models are in accordance with 40 CFR 61 (EPA 1989c) requirements.
8b	Complete documentation of models, input data, and computer programs should be provided in a manner that supports the annual site environmental report or other application.	Yes		Documentation of the programs has been provided by the model source, PNL.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
8c	Default values used in model applications should be documented and evaluated to determine appropriateness to the specific modeling situation.	Yes		Documentation of default values is incorporated into the PNL provided model packages.
8d	When performing human foodchain assessments, a complete set of human exposure pathways should be considered, consistent with current methods, and should be documented supporting the site Environmental Monitoring Plan.	Yes		The foodchain assessment considered exposure pathways consistent with current methods.
8e	Surface- and groundwater modeling should be conducted as necessary to conform with the applicable requirements of the State government and the regional office of the EPA.	Yes		Modeling for surface and groundwater has been performed.
8f	The general quality assurance program provisions of Chapter 10 of this guide should be followed as they apply to performing calculations that assess dose impacts.		No	Audits of the program have not been performed as required.
9a Records and Reports	DOE officials and DOE Management and Operating Contractors should identify and comply with the relevant reporting requirements.	Yes		Relevant reporting requirements have been identified and compliance procedures developed.
9b	Timely notification of occurrences and information involving DOE and its contractors should be made to the appropriate DOE officials and to other responsible authorities.	Yes		Currently, a timely notification regarding an occurrence is related to notification after discovery/identification. Sample analysis time may delay discovery/identification greatly.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
9c	Auditable records relating to environmental surveillance and effluent monitoring should be maintained. Calculations, computer programs, or other data handling should be recorded or referenced.	Yes		Materials are maintained which provide auditable records for the environmental program.
9d	As they apply to records and reporting activities, the general quality assurance program provisions of Chapter 10 of this guide should be followed.	Yes		Auditable records and reports are available.
10a Quality Assurance	A QA Plan should be prepared and included as a section of the Environmental Monitoring Plan and should cover the monitoring activities at each site, consistent with applicable elements of the 19-element format in ANSI/ASME NQS-1.	Yes		A QA plan has been prepared and incorporated into the FEMP. The QAPP (WHC 1991d) developed for the Hanford Site will provide this format.
10b	Periodic audits should be performed to verify compliance with operational procedures, QC procedures, and all aspects of the QA program.		No	Periodic audits have not been performed for compliance verification. The QAPP developed for the Hanford Site will correct this deficiency.
10c	Audits should be performed independently in accordance with written procedures or checklists by personnel who do not have direct responsibility for performing the activities being audited (i.e., supervisors cannot audit their own facilities).		No	No audits of the program have been performed.

Table 16-4. Environmental Regulatory Guide For Radiological Effluent Monitoring And Environmental Surveillance, DOE/EH-0173T. (15 sheets)

Section	DOE/EH-0173T Requirement	YES	NO	Remarks
10d	Audit results should be documented and reported to and reviewed by responsible management. Follow-up action should be taken where indicated.		No	Since audits have not been performed, no results are available.
10e	The elements of a QA program should be derived from the 18 criteria in ANSI/ASME NQA-1 and those stipulated in 10 CFR Part 50.	Yes		The elements of the program have been derived from the ANSI/ASME NQA-1 criteria (ANSI/ASME 1986).
10f	Radiation measuring equipment, including portable instruments, environmental dosimeters, in situ monitoring equipment, and laboratory instruments, should be calibrated with standards traceable to NIST calibration standards.	Yes		Calibration of radiation measuring equipment is performed in accordance with appropriate requirements.

Table 16-5. Washington Administrative Code 173-400 General Regulations For Air Pollution Sources.

Section	WAC 173-400 Requirement	YES	NO	Remarks
WAC 173-400-105 (1) Records and Reporting	The owner or operator of a stationary source listed in a source category of WAC 173-400-100 shall upon notification by the director, maintain records on the type and quantity of emissions from the source and other information deemed necessary by the director to determine whether the source is in compliance with applicable emission limitations and control measures.	Yes		K Area has no such facility.
173-400-120(6) Monitoring and Special Report	Emission inventory. The owner or operator of any air contaminant source shall submit an inventory of emissions from the source each year upon a form and according to instructions received from the Department of Ecology or cognizant local authority. The inventory may include stack and fugitive emissions of particulate matter, PM-10, sulfur dioxide, carbon monoxide, total reduced sulfur compounds (TRS), fluorides, lead, volatile organic compounds, and other contaminants, and shall be submitted when required no later than one hundred five days after the end of the calendar year.	Yes		K Area has no such facility.

Table 16-6. Washington Administrative Code 173-480 Ambient Air Quality Standards And Emission Limits For Radionuclides.

Section	WAC 173-480 Requirement	YES	NO	Remarks
WAC 173-480-070 EMISSION MONITORING AND COMPLIANCE PROCEDURES.	(1) The procedures specified in chapter 402-80 WAC shall be used to determine compliance with the standard. Radionuclide emissions shall be determined and dose equivalents to members of the public shall be calculated using department of social and health services approved sampling procedures, department of social and health services approved models, or other procedures, including those based on environmental measurements that department of social and health services has determined to be suitable.	Yes		Sampling methods will be approved by EPA, and are currently undergoing revision. The model used for dose calculation, CAP-88 (Beres 1990), is approved by EPA for use in dose calculations. PNL's GENII (Napier et al. 1988) program is used to perform dose calculations of releases to the river. This model is approved for use by DOE.

16.3 RELEASE POINT SPECIFICATIONS

16.3.1 Airborne Effluent Release Point Specifications

105-KE Basin Exhaust

<u>Physical Dimensions</u>	
Height From Ground:	15 ft
Exit Dimensions:	2 ft by 3 ft
Flow:	27,000 ft^3/min
Exit Velocity:	75 ft/s
Treatment:	None
Controls:	None
<u>Sampling System</u>	
Sampler:	47-mm filter
Sample Pump:	Gast Integral Vacuum Pump Model 0522
Sample Flow:	1.2 ft^3/min (no rotameter)
Sample Line:	35 ft of 5/8-in. stainless steel tubing with two 90° bends
Comments:	Cartridge has flow limiting orifice, vacuum gauge provides visual check of flow rate.

105-KW Basin Exhaust

<u>Physical Dimensions</u>	
Height From Ground:	22 ft
Exit Dimensions:	2 ft by 3 ft
Flow:	27,000 ft^3/min
Exit Velocity:	75 ft/s
Treatment:	None
Controls:	None
<u>Sampling System</u>	
Sampler:	47-mm filter
Sample Pump:	Gast Integral Vacuum Pump Model 0522
Sample Flow:	1.2 ft^3/min (no rotameter)
Sample Line:	35 ft of 5/8-in. stainless steel tubing with two 90° bends
Comments:	Cartridge has flow limiting orifice, vacuum gauge provides visual check of flow rate.

1706-KEL Laboratory Exhaust

<u>Physical Dimensions</u>	
Height From Ground:	25 ft
Exit Dimensions:	1.5-ft dia
Flow:	12,000 ft^3/min
Exit Velocity:	28.3 ft/s
Treatment:	HEPA
Controls:	None

Sampling System

Sampler:	47-mm filter
Sample Pump:	Dia-Vac Vacuum Pump Model 19320T
Sample Flow:	1.2 ft^3/min (no rotameter)
Sample Line:	8 ft of 5/8-in. stainless steel tubing with three 90° bends
Comments:	None

1706-KER Exhaust (Inactive)

Physical Dimensions

Height From Ground:	12 ft
Exit Dimensions:	1-ft dia
Flow:	2,500 ft^3/min
Exit Velocity:	13.2 ft/s
Treatment:	HEPA
Controls:	None

Sampling System

Sampler:	47-mm filter
Sample Pump:	Dia-Vac Vacuum Pump Model 0522
Sample Flow:	1.2 ft^3/min
Sample Line:	Approximately 10 ft of 5/8 in. stainless steel tubing with four 90° bends.
Comments:	None

16.3.2 Liquid Effluent Release Point Specifications Outfall 003 (181-KE Filter Backwash)

Physical Dimensions

Location:	Below waterline, near shoreline 575 ft from 181-KE towards mid-channel
Exit Dimensions:	Approximately 12-in. pipe
Flow:	5,000 gal/day average

Sampling System

Grab Sampled Only

Comments:	This outfall is grab sampled when operational

Outfall 004 (1908-KE)

Physical Dimensions

Location:	Under Columbia River, approximately mid-channel
Exit Dimensions:	Two pipes, 84 in.
Flow:	1.6 Mgal/day

<u>Sampling System</u>

Sampler:	Collins Composite Sampler Model 40-1P2
Sample Pump:	Berkeley Model 778 pump
Sample Line:	3/8-in. copper tubing
Comments:	None

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